Galaxy 3G Raid

G3G12-FC4SA
12 Bay 4GbFC to SAS / SATA-II RAID Subsystem

G3G12-S3S
12 Bay 3GbSAS to SAS / SATA-II RAID Subsystem

G3G16-FC4SA
16 Bay 4GbFC to SAS / SATA-II RAID Subsystem

G3G16-S3S
16 Bay 3GbSAS to SAS / SATA-II RAID Subsystem

Hardware
Product Manual

Version 110107

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This manual only applies to the Galaxy 3G Raid System.

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This version of the Product Manual supersedes all previous versions.

About This Manual

This manual:

- Introduces the GALAXY 3G RAID subsystem series.
- Describes all the active components in the subsystem.
- Provides recommendations and details about the hardware installation process.
- Describes how to setup and use the G3G
- Describes how to monitor the subsystem with Galaxy GAM, CLI, and CLU.
- Describes how to maintain the subsystem.

Revision History

- ***Initial release***

Who should read this manual?

This manual should be read by users, operators, and maintainers of the Galaxy 3G Raid system. This manual assumes that its readers are experienced with computer hardware installation and are familiar with storage enclosures.

Warnings and Certifications

Electric Shock Warning!

To Prevent Electric Shock:

Access to this equipment is granted only to trained operators and service personnel who have been instructed of and fully understand the possible hazardous conditions and the consequences of accessing non-field-serviceable units. For example, accessing the backplane may cause electric shock.

FCC (applies in the U.S. and Canada)

FCC Class A Note

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device may accept any interference received, including interference that may cause undesired operation.

WARNING:

Use only shielded cables to connect I/O devices to this equipment.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

CE

Warning: This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

CB

This device meets the requirements of the CB standard for electrical equipment with regard to establishing a satisfactory level of safety for persons using the device and for the area surrounding the apparatus. This standard covers only safety aspects of the above apparatus; it does not cover other matters, such as style or performance.

Other Certifications

VCCI, C-Tick, cUL, TUV, BSMI

MIC Statement

A급 기기 (업무용 정보통신기기)

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 만약 잘못판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

RoHS 2002/96/EC compliant

WEEE Disposal of Old Electrical and Electronic Equipment

Safety Precautions

Precautions and Instructions

- **Prior to powering on the subsystem, ensure that the correct power range is being used.**
- **The Galaxy3G RAID subsystem may come with up to twelve (12) drive bays. Leaving any of these drive bays empty will greatly affect the efficiency of the airflow within the enclosure, and will consequently lead to the system overheating, which can cause irreparable damage.**
- **If a drive module fails, leave it in place until you have a replacement unit and you are ready to replace it.**
- **Airflow Consideration: The subsystem requires an airflow clearance, especially at the front and rear.**
- **Handle subsystem modules using the retention screws, extraction levers, and the metal frames/faceplates. Avoid touching PCB boards and connector pins.**
- **To comply with safety, emission, or thermal requirements, none of the covers or replaceable modules should be removed. Make sure that during operation, all enclosure modules and covers are securely in place.**
- **Be sure that the rack cabinet into which the subsystem chassis will be installed provides sufficient ventilation channels and airflow circulation around the subsystem.**
- **Provide a soft, clean surface to place your subsystem on before working on it. Servicing on a rough surface may damage the exterior of the chassis.**
- **If it is necessary to transport the subsystem, repackage all disk drives separately. If using the original package material, other replaceable modules can stay within the enclosure.**
- **Dual redundant controller models come with two controller modules that must be installed into the subsystem. Single controller models come with a single controller module and a metal sheet is placed over the lower controller bay at the rear of the subsystem; this metal sheet should NEVER be removed.**

ESD Precautions

Observe all conventional anti-ESD methods while handling system modules. The use of a grounded wrist strap and an anti-static work pad is recommended. Avoid dust and debris or other static-accumulative materials in your work area.

Important data protection information

You should back up all data before installing any drive controller or storage peripheral. Rorke Data is not responsible for any loss of data resulting from the use, disuse or misuse of this or any other Rorke Data product.

Galaxy 3G Updates

Please contact your system vendor for the latest software or firmware updates.

NOTE that the firmware version installed on your system should provide the complete functionality listed in the specification sheet / user's manual.

We provide special revisions for various application purposes. Therefore, DO NOT upgrade your firmware unless you fully understand what a firmware revision will do. Problems that occur during the updating process may cause unrecoverable errors and system down time. Always consult technical personnel before proceeding with any firmware upgrade.

Conventions

Naming

From this point on and throughout the rest of this manual, the Galaxy 3G is referred to as simply the "G3G", "subsystem" or the "system."

Lists

Bulleted Lists: Bulleted lists are statements of non-sequential facts. They can be read in any order. Each statement is preceded by a round black dot "•."

Numbered Lists: Numbered lists are used to describe sequential steps you should follow in order.

Important information that users should be aware of is indicated with the following icons:

CAUTION!

Cautionary messages should also be heeded to help you reduce the chance of losing data or damaging the system.

IMPORTANT!

The Important messages pertain to information about the GALAXY subsystem that should be taken as strong suggestions for ease of use and functionality.

WARNING!

Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously.

NOTE:

These messages inform the reader of essential but non-critical information. These messages should be read carefully as any directions or instructions contained therein can help you avoid making mistakes.

Section 1
Introduction and Overview

1.0 Introduction and Overview

1.1 Product Overview

This hardware manual briefly introduces the Galaxy 3G models:

- G3G12-FC4 [Fibre Channel host with 12 SAS or SATA drives]
- G3G12-S3 [SAS host with 12 SAS or SATA drives]
- G3G16-FC4 [Fibre Channel host with 16 SAS or SATA drives]
- G3G16-S3 [SAS host with 16 SAS or SATA drives]

G3G12-FC4 / G3G12- S3 RAID Subsystem

G3G16-FC4 / G3G16- S3 RAID Subsystem

shown in the figure. The G3G subsystem comes with either two (2) 400MB/second 4Gb FC host channels or two (2) 1200MB/Second SAS host channels per RAID controller. The G3G comes with either single or dual redundant RAID controllers. This high-density subsystem supports up to sixteen (16) SATA-II hard drives in a 3U rack profile chassis. The subsystem is managed by a RAID controller module featuring the latest RAID6 technologies. The subsystem comes with a pre-installed 512MB DDR RAM DIMM module that can be replaced by one with the 2GB capacity.

The subsystem is equipped to handle RAID levels 0, 1, 1E, 5, 6, 10, 50, and 60 – Any combination of these RAID levels can exist at the same time.

Configurable RAID stripe size: 64 KB, 128 KB, 256 KB, 512 KB, and 1 MB stripe size per logical drive. Sophisticated Data Protection and Error Handling include such features as Bad Block Remapping and Media Patrol. These features scan the system's drive media to ensure that even bad physical drives do not impact data availability

A RAID6 array configuration allows two (2) disk drive failures to occur at the same time. This feature marks a giant step forward for providing a higher level of data integrity. RAID level 6 and the combinations of striped RAID6 arrays (RAID60) are both supported.

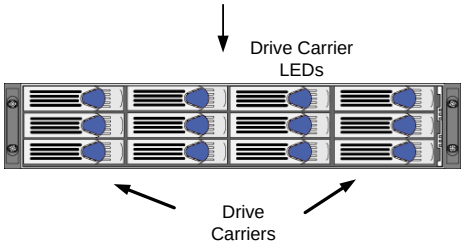
Two (2) redundant cooling modules provide cooling airflow within the subsystem. Two (2) redundant and hot-swappable power supply unit (PSU) modules provide constant power to the subsystem. A cache battery backup unit (BBU) is replaceable as well. The modular design of the subsystem provides the ease of access to all major modules and hence reduces the maintenance efforts.

1.2 Chassis Overview

The Galaxy 3G RAID storage subsystem comes in a robust metal chassis. The chassis is comprised of the front and rear sections, which are respectively accessed through the front and rear panels. We provide separately purchased mounting rails or end-brackets for the installation into a standard 19" rack cabinet. Detailed description of major components can be found in the following sections.

Galaxy 3G provides data storage solutions for applications where high performance and data protection are required. The failure of any single drive will not affect data integrity or accessibility of the data in a RAID protected logical drive.

Fig 1.2a Galaxy 3G 12 and 16 bay front view



A defective drive may be replaced without interruption of data availability to the host computer. If so configured, a hot spare drive will automatically replace a failed drive, securing the fault-tolerant integrity of the logical drive. The self-contained hardware-based RAID logical drive provides maximum performance in a compact external chassis.

1.3 Architectural Description

The Galaxy 3G G3G12 / 16-FC4 is a Fibre Channel subsystem suitable for Direct Attached Storage (DAS) or Storage Area Network (SAN), and Expanded Storage.

The Galaxy 3G G3G12 / 16-S3 is a Serial Attached SCSI (SAS) subsystem suitable for Direct Attached Storage (DAS), Cascaded Storage, and Expanded Storage.

The G3G12 /16-FC4 and G3G12 / 16-S3 subsystems support:

1.5 Gb/s SATA disk drives

3.0 Gb/s SATA disk drives

3.0 Gb/s SAS disk drives

All enclosures include a mid-plane, RAID controller, power and cooling units, and enclosure processor all in one cable-less chassis design. Multiple fans and power supplies provide redundancy to ensure continued usage during component failure. The RAID controller is hardware based and controls all logical drive functions transparently to the host system. Galaxy 3G appears to the computer's operating system as a standard SCSI drive or drives.

Fig 1.2b Galaxy 3G G3G12 / 16-FC4 rear view

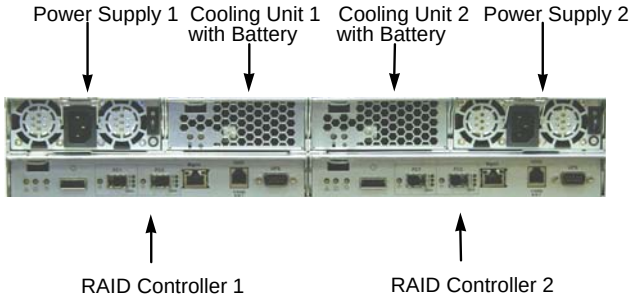
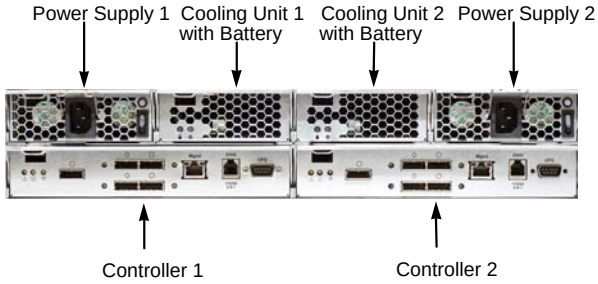


Fig 1.2c Galaxy 3G G3G12 / 16-S3 rear view



1.4 Features and Benefits

Highlights

- Models include Single or Dual channel active/active, failover/failback RAID controllers
- 12 or 16 hot-swappable drive bays in a robust rackmount chassis with redundant, hot-swappable power and cooling modules
- Support for Serial Attached SCSI (SAS) and Serial ATA (SATA) 3 Gb/s drives simultaneously in the same system—choose the drive that is best suited to your application
- Dual Fibre Channel and SAS host ports provide high-availability SAN and cluster-friendly platform
- JBOD expansion support through a 3 Gb/s SAS x4 port—up to four Galaxy 3G JBOD systems
- Simplified remote management with a comprehensive embedded web-based management via Ethernet—***Galaxy Array Manager,***. Command Line Interface/Utility via RJ-11 Serial Port
- Support for the latest RAID technology—RAID 6 and 60—Protection from a catastrophic double drive failure
- Resilient data protection features such as Data Migration, SMART monitoring, and Media Scan
- LUN Mapping and Masking bring flexibility for multiple application and OS support on the same storage subsystem
- Open architecture, industry's most comprehensive support for SAS and SATA hard drives and standards-based management interfaces including SNMP, CIM, and WBEM
- Support for the industry standard Disk Data Format (DDF from SNIA) ensures interoperability and drive roaming even among different RAID vendors
- Compatible with leading SAS and SATA hard drives, host bus adapters, switches and operating systems

Subsystem and Controller Features

- Controllers: Dual-controller configuration or single-controller configuration. Dual-controller subsystems feature Active/Active, Failover/Failback.
- Drive Support: Up to twelve 3.5" x 1" hard disk drives: SAS 3Gb/s, SATA II 3Gb/s and 1.5Gb/s. SATA drives require an AAMUX Adapter in dual I/O module configuration (dual-controller) subsystems.
- Supports any mix of SAS and SATA II 3Gb/s or 1.5Gb/s drives simultaneously in the same system. Staggered physical drive spin-up.

- Dual SAS or 4-Gb Fibre Channel host I/O Ports (per controller):; One external 3 Gb/s SAS x4 ports for JBOD expansion (add up to four Galaxy 3G JBOD Systems).
- Data Cache: Shared 512 MB predictive data cache (expandable to 2 GB); Automatic write cache de-staging; 72-hour battery backup (for 512 MB cache).
- Command Queue Depth: 512 commands per Galaxy 3G system (up to 1024 commands with 512 MB memory).

Operational Features

- RAID Levels: RAID 0, 1, 1E, 5, 6, 10, 50, and 60 – Any combination of these RAID levels can exist at the same time.
- Configurable RAID stripe size: 64 KB, 128 KB, 256 KB, 512 KB, and 1 MB stripe size per logical drive.
- Background task priority tuning: Adjustment of minimum I/O reserved for server use during all background tasks.
- Hot spares: Multiple global or dedicated hot-spare drives with revert option.
- Maximum LUNs per subsystem: 256 in any combination of RAID levels.
- Maximum LUNs per array: 32 logical drives (LUNs). Supports LUN carving by allowing an array to be divided into multiple logical drives. Supports out-of-order logical drive deletion and re-creation.
- Max LUNs per Target ID: Up to 256, depending on host side driver and operating system.
- LUN Masking and Mapping: Supports multiple hosts.
- Disk Data Formats: Supports Disk Data Format (DDF) for industry-wide standardization and drive roaming between Galaxy 3G systems.
- Background Activities: Media Patrol, background synchronizing, disk array rebuild, Redundancy Check, SMART condition pooling, Online Capacity Expansion (OCE), RAID Level Migration (RLM). Includes priority control, rate control, and watermarking per BGA in disk and NVRAM.
- Foreground Activities: Disk array initialization.
- Physical Drive Error Recovery: Predictive Data Migration (PDM), replaces un-healthy disk member in array, while maintaining normal array status during the data transition. Bad Sector Mapping, Media Patrol, SMART, Hard/Soft Reset to recover HD from bad status, HD Power-control to recover HD from hung status.

- Array Error Recovery: Data recovery from bad sector or failed HD for redundant RAID, RAID 5/6 inconsistent data Prevent (Write Hole Table), Data content Error Prevent (Read/Write Check Table) NVRAM event logging.

- SCSI Commands: Supports extensive SCSI command set equivalent to SCSI/FC hard disk drives. Variable sector size (512 byte to 4 KB) to break OS 2TB limitation. 16 byte CDB support for 64-bit LBA addressing.

Management

- Supported Operating Systems: Windows 2000 Server, Windows 2003 Server, Linux (Red Hat, SuSE), Macintosh OS X, Solaris.

- Management Tools: Galaxy Array Manager via out-of-band Ethernet. OS independent, localized in multiple languages, SSL Security support. Command Line Interface (CLI) and Command Line Utility (CLU) via RJ-11 Serial Port or Telnet.

- Standard Management Protocols: SNMP, WBEM/CIM

- RAID Creation: Automatic, Express, and Advanced configuration support for novice to skilled users.

- Management Interfaces: Galaxy Array Manager, CLU, CLI, audible (buzzer) and visible (LEDs) alarms.

- Management Protocols: Embedded web server and management support—no host agent needed. Ethernet, RJ-11 serial port, SNMP, SSL, Telnet, Email.

1.5 Specifications

G3G12 chassis

Current (maximum): 8 A @ 100 VAC or 4 A @ 240 VAC Current rating with two power cords.

Power Consumption: 78.67 W (not including disk drives).

Power Supply: Dual 400W, 100-240 VAC auto-ranging, 50-60 Hz, dual hot swap and redundant.

Operating Temperature: 5° to 40ûC operational (-40° to 60ûC non-operational)

Relative Humidity: Maximum 95 percent.

Vibration: Random, 0.21 grms, 5-500Hz, 30Mins, X, Y, Z axis.

Dimensions (H x W x D): 8.8 x 44.4 x 56.1 cm (3.5 x 17.5 x 22.1 in)

Net Weight (subsystem only): 22 kg (49 lb) without drives, 28 kg (62 lb) with 12 drives, assuming 0.5 kg (1.1 lb) per drive.

Gross Weight (including carton): 30 kg (66 lb) without drives.

Safety: CE, FCC Class A, VCCI, C-Tick, cUL, TUV, CB, BSMI.

G3G16 chassis

Voltage: 100–240 VAC Auto-ranging.

Current (maximum): 8 A @ 100 VAC or 4 A @ 240 VAC Current rating with two power cords.

Power Consumption (not including disk drives): 151.42 W.

Power Supply: Dual 500 W, 100-240 VAC auto-ranging, 50-60 Hz, dual hot swap and redundant with PFC, N+1 design.

Operating Temperature: 5° to 40ûC operational (-40° to 60ûC non-operational)

Relative Humidity: Maximum 95 percent.

Vibration: Random, 0.21 grms, 5-500 Hz, 30 Mins, X, Y, Z axis.

Dimensions (H x W x D): 13.1 x 44.6 x 56.1 cm (5.2 x 17.6 x 22.1 in)

Net Weight: 30.5 kg (67.2 lb) without drives, 38.5 kg (84.9 lb) with 16 drives, assuming 0.5 kg (1.1 lb) per drive.

Gross Weight (including carton): 37.5 kg (82.7 lb) without drives.

Safety: CE, FCC Class A, VCCI, C-Tick, cUL, TUV, CB, BSMI, MIC.

Section 2
Installation / Connectivity

2.0 Installation and Connectivity

This chapter covers the following topics:

- 2.1 Unpacking the G3G
- 2.2 Mounting G3G in a Rack
- 2.3 Installing Disk Drives
-

- 2.4 Configuring Management and Data Cable Connections
- 2.5 2.5 Making Serial cable connections
- 2.6
  2.6 Connecting the Power fig 2.4.4a

2.1 Unpacking the G3G

The G3G comes in two [2] boxes, one of which contains the G3G RAID drives and the other contains the following items:

- G3G RAID Unit
- Quick Start Guide
- Left and right center-mount brackets
- Left and right mounting rails
- RJ11-to-DB9 serial data cable
- 1.5m (4.9 ft) Power cords (2)
- CD with Product Manual and Quick Start Guide

Warning

The electronic components within the G3G disk array are sensitive to damage from Electro-Static Discharge (ESD). Observe appropriate precautions at all times when handling the G3G or its subassemblies.

Important

Use the following categories of network cables with the G3G:

- Cat 6, preferred
- Cat 5E, minimum

2.2 Mounting G3G in a Rack

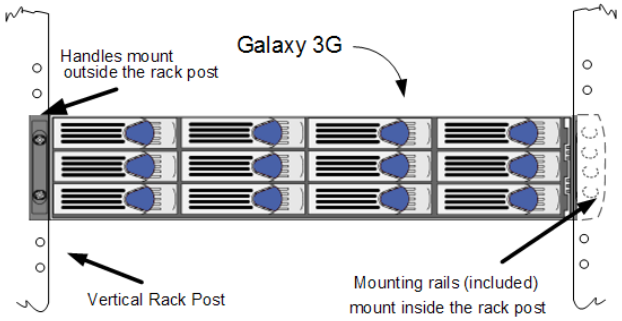
Important

For ease of use the G3G12 chassis is shown for the mounting in a rack. The G3G16 chassis follows the same procedure.

Rack Installation fig 2.2a

The Galaxy 3G subsystem installs into a standard 19 inch wide, 24 inch deep rack using the supplied mounting rails. You can also use your existing rails.

Fig 2.2a Galaxy 3G mounted in rack



Cautions

- At least two persons are required to safely lift, place, and attach the G3G enclosure into a rack system.
- Do not lift or move the G3G enclosure by the handles, power supplies or the controller units. Hold the enclosure itself.
- Do not install the G3G enclosure into a rack without rails to support the enclosure.

Rack Hardware and Mounting fig 2.2b

To install the G3G enclosure into a rack with the supplied mounting rails:

- Check the fit of the mounting rails in your rack system.
- Slide the plates out of the mounting rails.
- Attach one plate to each side of the G3G enclosure.
- Line-up the two studs and six holes in the plate with the corresponding holes in the enclosure. Attach each plate with six screws (included).
- Slide one of the rails over the plate on one side of the enclosure.
- The rail is designed to slide freely over the plate.
- Attach a four-hole flange to the rail, with the flange toward the front (disk drive end) of the enclosure.

- Install four rail adjustment screws (included) through the flange into the rail.
- Attach a two-hole flange to the rail, with the flange toward the back (connector end) of the enclosure.
- Install four rail adjustment screws (included) through the flange into the rail.
- Repeat steps 4 through 6 to attach the other rail and flanges to the enclosure.
- Place the enclosure with mounting rails into your rack system.
- Attach the four-hole flanges to the inside of the rack's front post, using the attaching screws from your rack system.
- Attach the two-hole flanges to the inside of the rack's rear post, using the attaching screws from your rack system.
- Square the rails in the rack.
- Tighten the adjustment screws and the attaching screws.

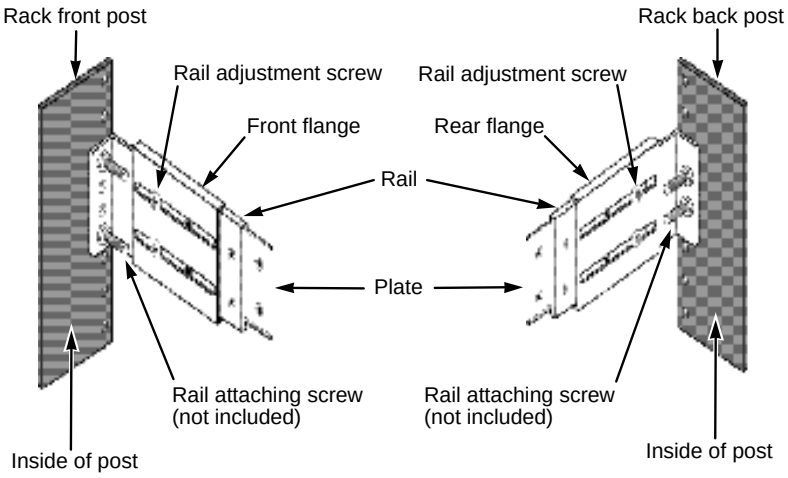


Fig 2.2b Rackmount hardware diagram

2.3 Installing Disk Drives

Your salesperson has passed on your RAID level requirements to our integration department and we have pre-configured your RAID level with a RAID Partition on them. The drives can be installed in any of the G3G drive slots since the G3G is intelligent enough to properly configure the RAID, once it is powered up, no matter where the drives are located in the chassis.

However, if you do want to re-configure you RAID, the G3G is capable of all the RAID levels displayed in the table below.

The following table can be used as a reference for various RAID levels. For optimal performance, install physical drives of the same model and capacity. The drives' matched performance allows the logical drive to function better as a single drive. The table below shows the number of drives required for each RAID level.

Level	Number of Drives		Level	Number of Drives
RAID 0	1 or more		RAID 6	4 to 16*
RAID 1	2 only		RAID 10	4 or more**
RAID 1E	2 or more		RAID 50	6 or more
RAID 5	3 to 16*		RAID 60	8 or more
* Drive counts above 12 require an expansion unit. ** Must be an even number of drives.				

Drive Slot Numbering fig 2.3a

Because your drives have been pre-configured at our facility with a RAID partition on it and the G3G is capable of automatically configuring the RAID partition, you can install the drives into any drive slot. The diagram below shows how G3G's drive slots are numbered. Slot numbering is reflected in the Galaxy Array Manager and CLU user interfaces and is important when identifying bad drives for replacement.

Install all of the drive carriers into the G3G enclosure to ensure proper airflow, even if you do not populate all the carriers with disk drives.

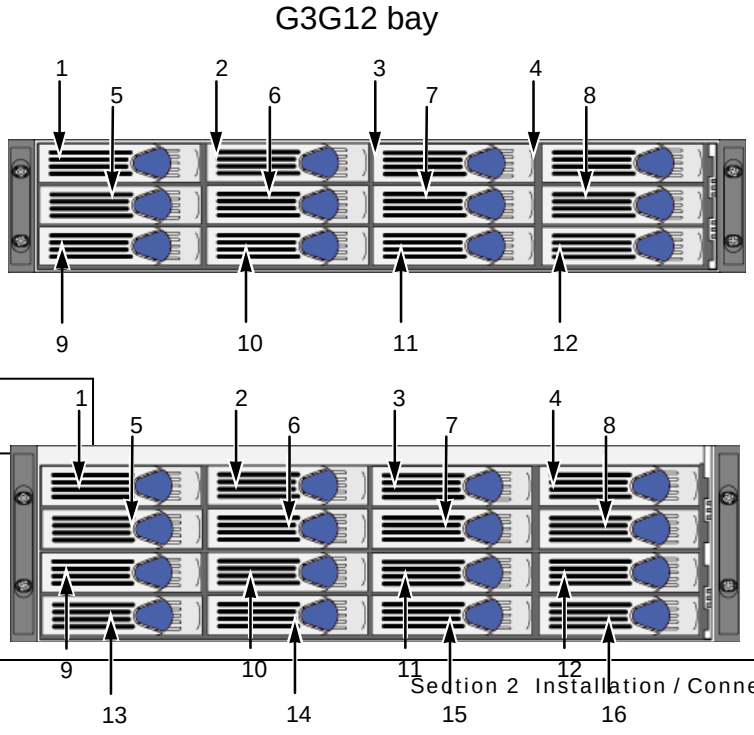


Fig 2.3a G3G drive slot numbers

AAMUX Adapter

If your G3G has dual controllers—Fibre Channel or SAS—and we have installed SATA drives, we have provided an AAMUX adapter with each SATA drive. AAMUX adapters must be used at all times on SATA drives in our dual controller models.

Installing Disk Drives fig 2.3b

Your disk drives have all been pre-integrated at our facility. In case a drive fails, use the following procedure to install a replacement drive:

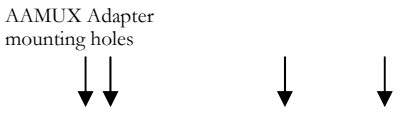
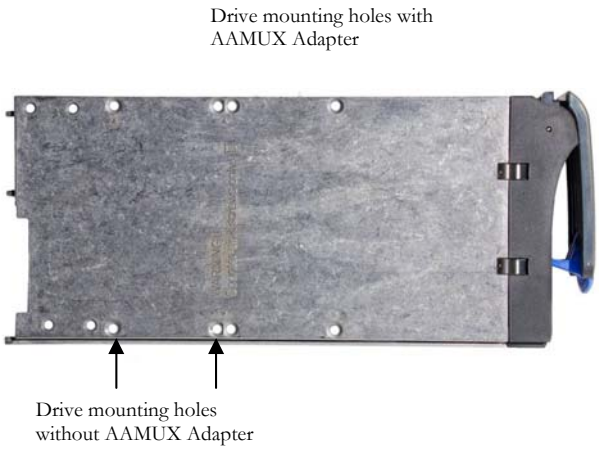


Fig 2.3b Disk drive mounting holes in the drive carrier



- Remove a disk drive carrier.
- SATA drives only. Place the AAMUX adapter into the disk drive carrier and attach it with the four screws. Reference figure 2.3b and figure 2.3c below
- Install only the screws supplied with the adapter.
- The adapter fits into the carrier with the SAS connector at the back.
- Snug each screw. Be careful not to over tighten.
- Carefully lay the disk drive into the drive carrier at the front, so that the screw holes on the bottom line up.
- If you installed an AAMUX adapter, lay the SATA disk drive into the carrier and slide it so the power and data connectors insert in to the adapter.
- Insert the screws through the holes in the drive carrier and into the bottom of the disk drive. Reference figure 2.3b
- Install only the counter-sink screws supplied with the G3G.
- Install four screws per drive.
- Snug each screw. Be careful not to over-tighten.
- Reinstall the drive carrier into the G3G chassis.
- Repeat steps 2 through 5 until all of your disk drives are installed.

Fig 2.3c SATA drive mounted with AAMUX

Fig 2.3d SAS drive mounted in drive carrier

2.4 Configuring Management and Data Cable Connections

Important

For ease of use the G3G12 chassis is shown for the cable and connectivity configurations. The G3G16 connections are identical and follow the same procedure.

For Serial Attached SCSI [SAS] host setup, go to 2.42 Serial Attached SCSI host setup

Fibre Channel Host Setup fig 2.4.1a

G3G models can have one or two RAID controllers. Each controller has an Ethernet (RJ45) Management Port connector that enables you to monitor the G3G over your network using the Galaxy Array Manager Software. G3G supports HTTP(S) and Telnet protocols.

The G3G RAID controller has two 4-Gb Fibre Channel (FC) connections for the data ports. See figure 2.4.1a.

You can configure your G3G for:

Storage Area Network (SAN)

Direct Attached Storage (DAS)

JBOD Expansion using a SAS data connection

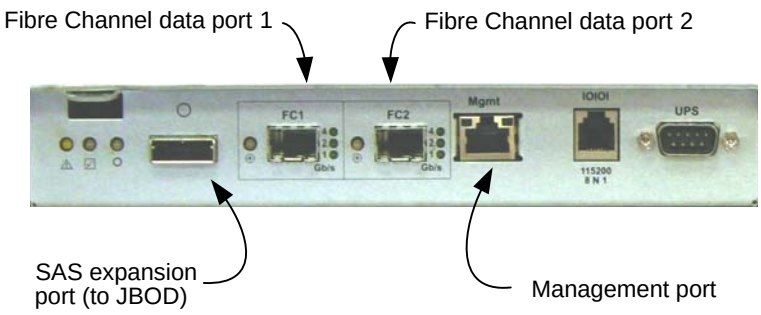


Fig 2.4.1a G3G Fibre controller description of cable connectivity

Configuring a Storage Area Network fig 2.4.1b

A storage area network (SAN) requires:

- A Fibre Channel switch
- A Fibre Channel HBA card in each Host PC or Server
- A network switch
- A network interface card (NIC) in each Host PC or Server

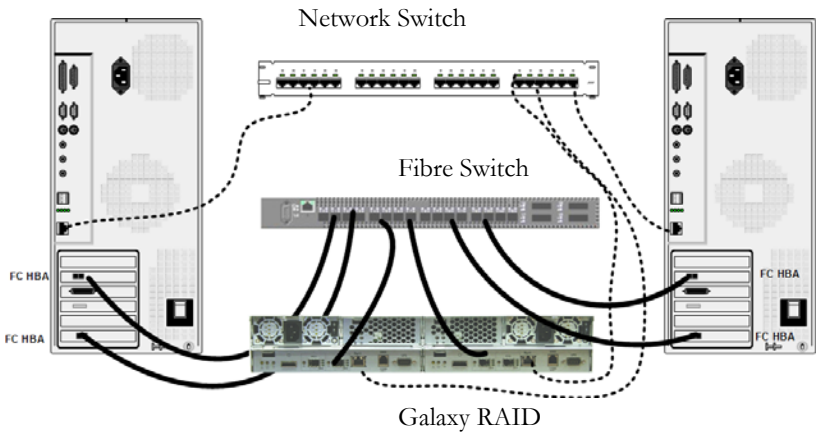


Fig 2.4.1b G3G Fibre SAN configuration

To establish the data path:

On each of the G3G controllers, connect one of the Fibre Channel data ports to your Fibre Channel switch.

On each server, connect both of your Fibre Channel HBA connections to the Fibre Channel switch.

To establish the management path:

1. On the G3G controller, connect the Management Port [Ethernet] to your Ethernet network switch

   Note that an ether connection from only one controller is necessary to manage the G3G with the Galaxy Array Manager. However an ether connection to both controllers does provide a redundant path in case the G3G controller fails over.

2. Connect each Host PC's or Server's standard NIC to your network switch.

Configuring Direct Attached Storage fig 2.4.1c

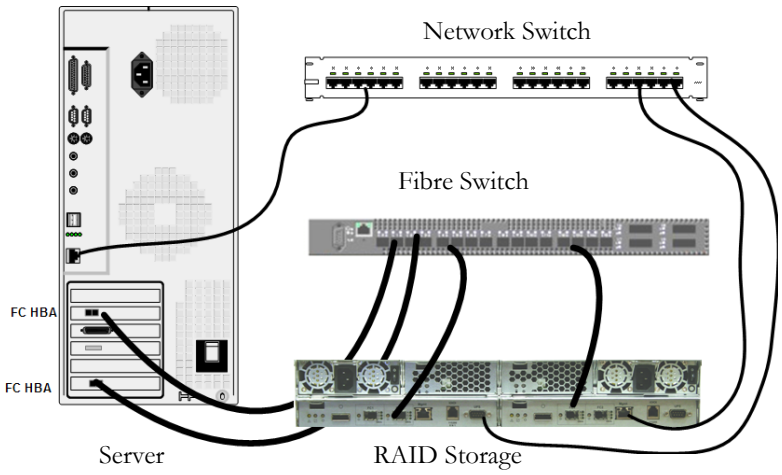
Direct attached storage (DAS) requires:

- Two Fibre Channel HBA cards in the Host PC or Server
- A network switch
- A network interface card (NIC) in the Host PC or Server

To establish the data path:

- On each G3G controller, connect one of the Fibre Channel data ports to your Fibre HBA port.:
- On the G3G controller, connect the Management Port to your network switch.
- Connect the Host PC's or Server's standard NIC to your network switch.

Fig 2.4.1c G3G Fibre DAS configuration



Adding and Configuring JBOD Expansion to the G3G12-FC4 fig 2.4.1d [Fibre Channel version of G3G]

To add expansion JBOD chassis to the Fibre Channel version of the G3G :

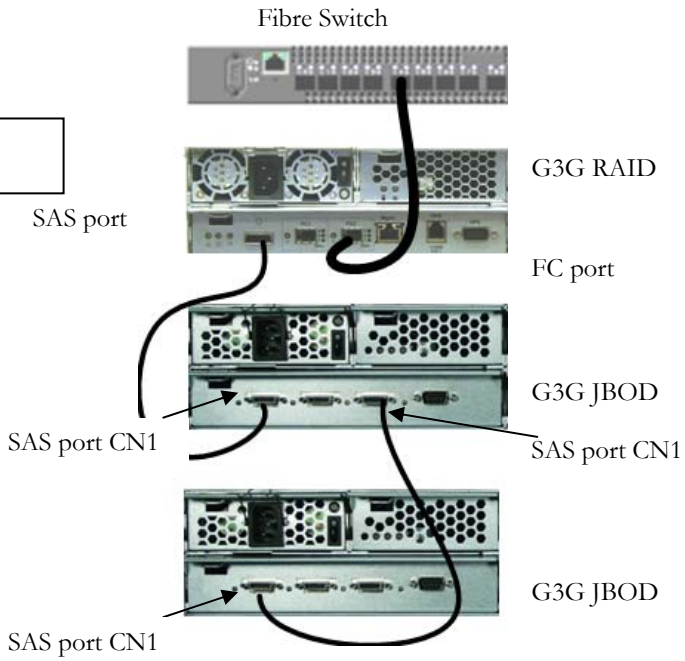
1. On each G3G Fibre controller, use a SAS cable to connect the SAS connector (a subtractive-routed port) to CN1 (a table-routed port) on the I/O module of the first G3G JBOD [G3G12-JBD/S] storage unit.

2. Using a SAS cable, connect CN3 (a subtractive-routed port) on the first G3G JBOD [G3G12-JBD/S] storage unit to CN1 on one of the I/O modules of the next G3G JBOD [G3G12-JBD/S] storage unit.

3. Connect the remaining G3G JBOD units in the same manner.

A maximum number of four [4] JBOD units can be added to any G3G RAID controller. If you have a dual controller G3G, then each controller should have the SAS JBODs added so that controller failover will see all the JBODs

Fig 2.4.1d G3G Fibre JBOD expansion cabling diagram.



Configuring No Single Point of Failure fig 2.4.1e

You can configure a SAN system with no single point of failure. Such a configuration requires:

- Two Fibre Channel switches
- Two Fibre Channel HBA cards in each Host PC or Server
- A network switch (not shown)
- A network interface card (NIC) in each Host PC or Server

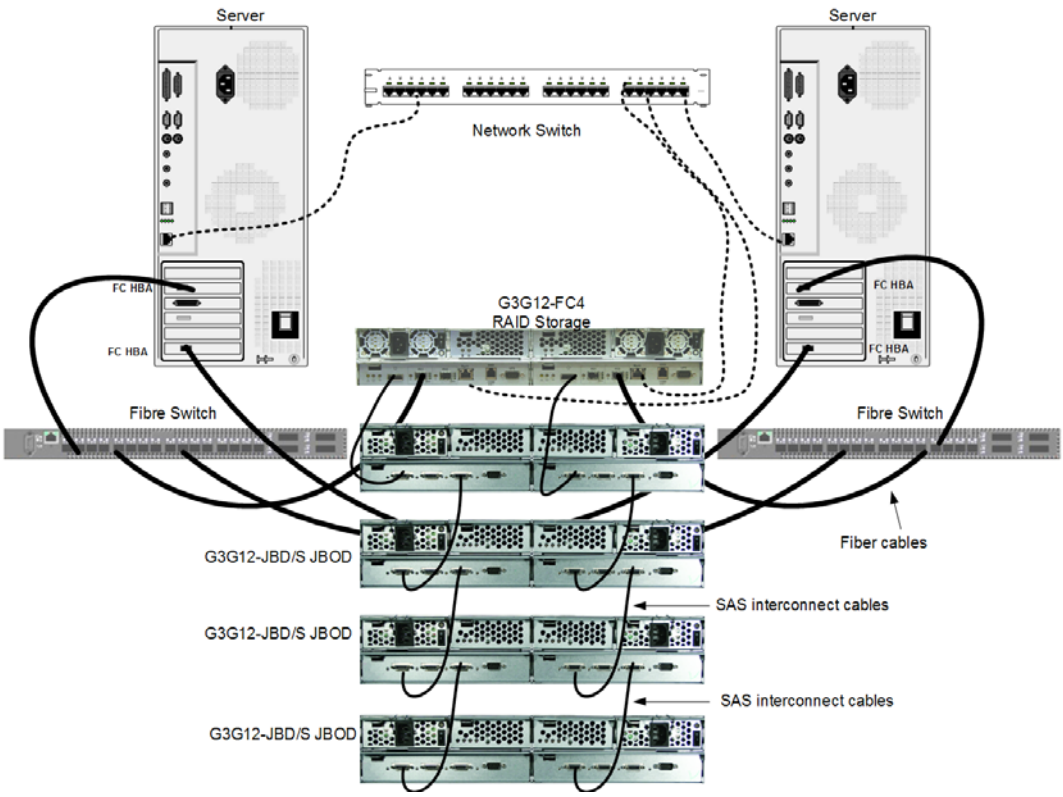


Fig 2.4.1e G3G Fibre in a NSPOF configuration

Serial Attached SCSI [SAS] Host Setup fig 2.4.2a

Galaxy G3G SAS Host RAID models can have one or two RAID controllers. Each controller has an Ethernet (RJ45) Management Port connector that enables you to monitor the G3G over your network using the Galaxy Array Manager Software. G3G supports HTTP(S) and Telnet protocols.

The standard G3G-S3 controller has three SAS ports:

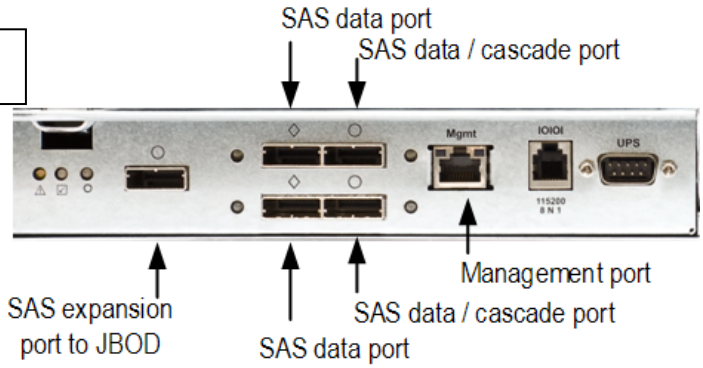
- Data port – Connects to the Host PC or Server
- Data/Cascade port – Connects to the data port of a second G3G12-S3 controller or to the Host PC or Server
- SAS Expansion port – Connects to a G3G12-JBD JBOD expansion subsystem

Your G3G-S3 has two data ports and two data/cascade ports, plus the SAS expansion port.

You can configure your G3G for:

- Direct Attached Storage (DAS)
- Cascaded Storage (Multiple E310s subsystems)
- JBOD Expansion using a SAS data connection

Fig 2.4.2a G3G12-S3 description of cable connectivity



Configuring Direct Attached Storage fig 2.4.2b

Direct attached storage (DAS) requires:

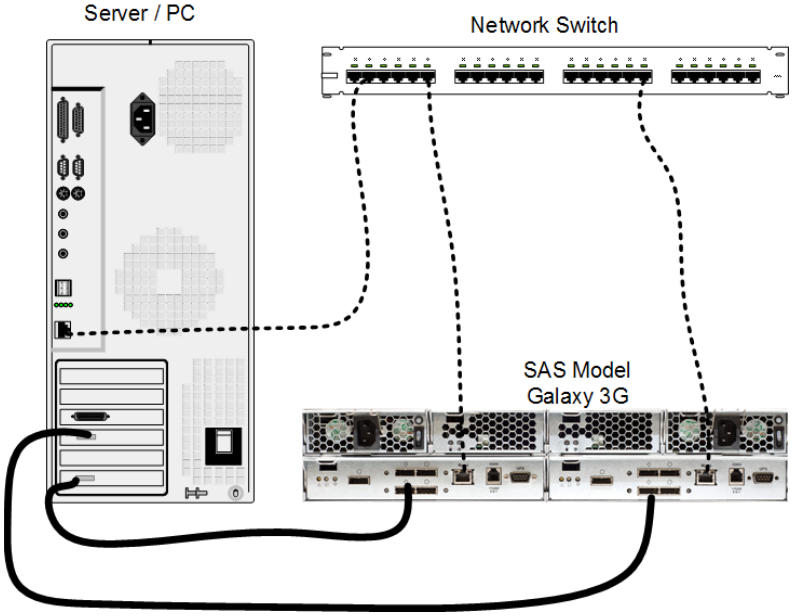
- Two SAS HBA cards in the Host PC or Server
- A network switch
- A network interface card (NIC) in the Host PC or Server

To establish the data path:

On the G3G12-S3 controller, connect a SAS data port or a SAS data/cascade port to one of your SAS HBA cards.

To establish the management path:

1. On the G3G controller, connect the Management Port on each Controller to your network switch. See See figure 2.4.2b



2. Connect the Host PC's or Server's standard NIC to your network switch.

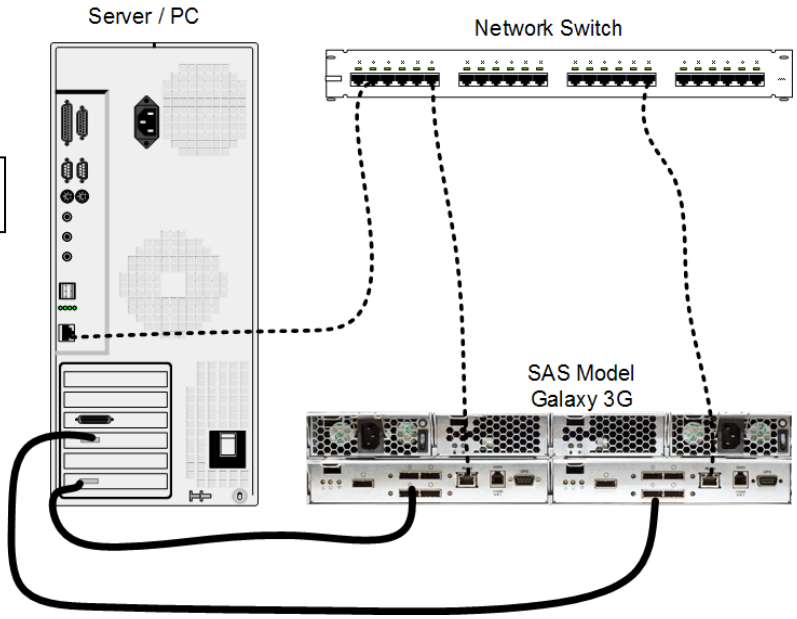


Fig 2.4.2b G3G12-S3 DAS configuration

Cascading or Daisy Chaining Galaxy 3G RAIDs fig 2.4.2c / 2.4.2d

Cascaded storage requires:

- One SAS HBA card in the Host PC or Server
- A network switch
- A network interface card (NIC) in the Host PC or Server

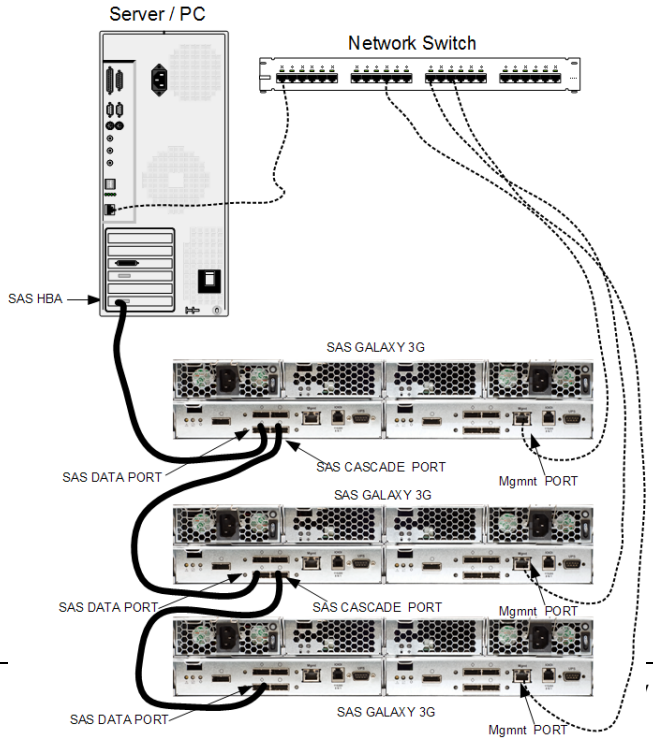
To establish the data path:

- On the G3G controller, connect a SAS data port or a SAS data/cascade port with the ♦ symbol to your SAS HBA card. See figure 2.4.2c **Error! Reference source not found.**
- Connect the data/cascade port (with the symbol ○) of the first G3G to the data port (with the symbol ♦) on the second G3G.
- Connect the remaining G3G controllers in the same manner.
- You can cascade up to eight G3G subsystems.

To establish the management path:

- On the G3G controller, connect the Management Port on each Controller to your network switch. See figure 2,4,2c
- Connect the Host PC's or Server's standard NIC to your network switch.

Fig 2.4.2c G3G12-S3 Cascade G3G configuration



Adding and Configuring JBOD Expansion to the G3G12-S3 fig 2.4.2d [Fibre Channel version of G3G]

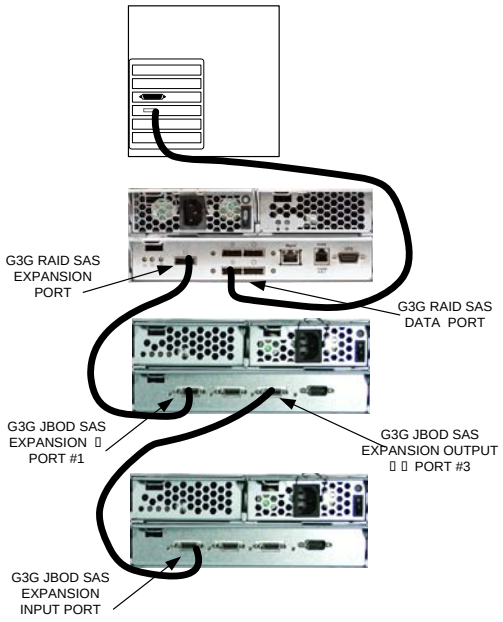
To add expansion JBOD chassis to the Fibre Channel version of the G3G :

1. On each G3G12-S3 controller, use a SAS cable to connect the SAS connector (a subtractive-routed port) to Port 1 (a table-routed port) on the I/O module of the first G3G JBOD [G3G12-JBD/S] storage unit.

2. Using a SAS cable, connect Port 3 (a subtractive-routed port) on the first G3G JBOD [G3G12-JBD/S] storage unit to CN1 on one of the I/O modules of the next G3G JBOD [G3G12-JBD/S] storage unit.

3. Connect the remaining G3G JBOD [G3G12-JBD/S] units in the same manner.

Fig 2.4.2d G3G12-S3 Adding JBOD to G3G configuration


G3G RAID SAS EXPANSION PORT
G3G RAID SAS DATA PORT
G3G JBOD SAS EXPANSION PORT #1
G3G JBOD SAS EXPANSION OUTPUT PORT #3
G3G JBOD SAS EXPANSION INPUT PORT

Configuring No Single Point of Failure fig 2.4.2e

You can expand a SAN system with no single point of failure. See fig 2.4.2e. Such an arrangement requires:

- Two SAS HBA cards in each Host PC or Server
- A network switch (not shown)
- A network interface card (NIC) in each Host PC or Server
- One to four G3G JBOD subsystems

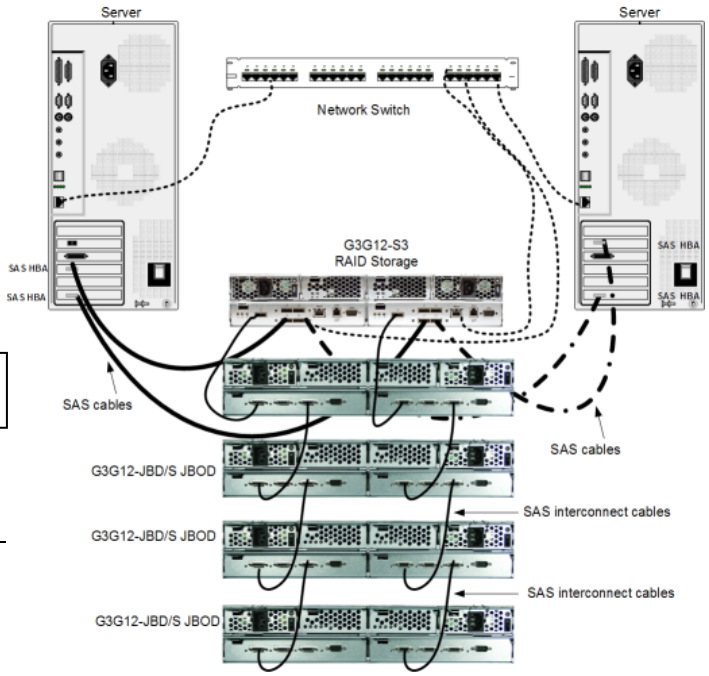
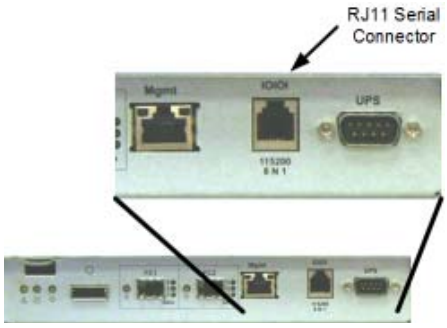


Fig 2.4.2e G3G12-S3 NPOF configuration

2.5 Making Serial Cable Connections fig 2.4.3a

RS232 serial communication enables the Command Line Interface (CLI) and Command Line Utility (CLU) on your PC to monitor and control the G3G. On G3G, RS232 communication goes through the RJ11 serial connector on each controller. A Serial cable [DB9 – RJ11] for your PC is included with the G3G.

Fig 2.4.3a G3G Serial Cable connector



To set up a serial cable connection:

1. Attach the RJ11 end of the RJ11-to-DB9 serial data cable, supplied with the G3G, to the RJ11 serial connector on one of the controllers.
2. Attach a null-modem cable to the DB9 end of the RJ11-to-DB9 serial data cable.
3. Attach the other end of the null-modem cable to a serial port on the Host PC or Server.

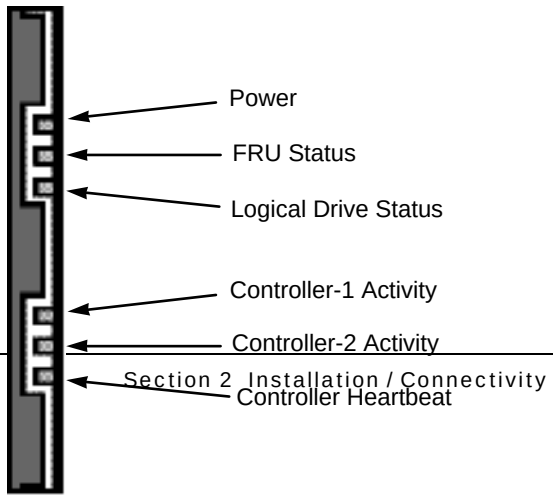
Note

The DB9 connector on the G3G controller is for a UPS support, which is planned for a future release.

2.6 Connecting the Power fig 2.4.4a

Plug the power cords and switch on both power supplies on. When the power is switched on, the LEDs on the front of the G3G will light up.

Fig 2.4.4a G3G Front panel LED display located near right handle



When boot-up is finished and the G3G is functioning normally:

- Controller Heartbeat LED blinks green once per second for five seconds, goes dark for ten seconds, then blinks green once per second for five seconds again.
- Power, FRU and Logical Drive LEDs display green continuously.
- Controller LEDs flash green if there is activity on that controller.

Drive Carrier Indicators fig 2.4.4.1a

There are two LEDs on each disk drive carrier. They report the presence of power and a

Fig 2.4.4.1a G3G Drive Carrier Indicators

disk drive, and the current condition of the drive.

After a few moments the Power/Activity LED should display Green. If there is no disk drive in the carrier, the Power/Activity LED will remain dark.

The Power/Activity LED flashes during drive activity.

The Disk Status LED displays Green when a drive is present and configured.

Section 3
Setup

3.0 Installation and Connectivity

This chapter covers the following topics:

- 3.1 Configuring the Serial Connection
-

3.2 Choosing DHCP or a Static I

-

3.3 Setting up the Galaxy 3G with the CLI

- 3.4

3.4 Setting up Galaxy 3G with the CLU

- 3.5 3.5 Creating Disk Arrays with Array Manager

3.1 Configuring the Serial Connection

Galaxy 3G has a Command Line Interface (CLI) to manage all of its functions, including customization. A subset of the CLI is the Command Line Utility (CLU), a user-level interface that manages your Galaxy 3G via your PC's terminal emulation program, such as Microsoft HyperTerminal. This procedure uses the serial cable connection you made. See "Making Serial Cable Connections" in section 2.

1. Change your terminal emulation program settings to match the following specifications:
   - Bits per second: 115200
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: none
2. Start your PC's terminal VT100 or ANSI emulation program.
3. Press Enter once to launch the CLI.
4. At the Login prompt, type **`administrator`** and press Enter.
5. At the Password prompt, type **`password`** and press Enter.

   At this point, you are in the CLI. You can continue using the CLI to make network settings or you can switch to the CLU. To use the CLU type menu and follow procedures in section 4 of the manual.

3.2 Choosing DHCP or a Static IP Address

When you setup your Galaxy 3G, you have the option of:

- Enabling DHCP and letting your DHCP server assign the IP address to the Galaxy 3G's virtual management port.
- Specifying a static IP address for the Galaxy 3G's virtual management port.

If you choose to specify static IP, have your Network Administrator dedicate an IP address for the Galaxy 3G, linked to the Galaxy 3G's MAC address. This action will prevent the DHCP server from assigning a new IP address when the Galaxy 3G restarts, with the result that users can no longer log in.

To access the MAC address for Galaxy 3G's virtual management port:

- In the CLI, type **`net -v`** and press Enter.
- In the CLU Main Menu, highlight Network Management and press Enter. Then highlight Virtual and press Enter.

The default static IP address of the Galaxy 3G is 192.168.1.129

3.3 Setting up the Galaxy 3G with the CLI

1. Type the following string to set the system date and time, then press Enter.

   ```
   administrator@cli> date -a mod -d 2006/08/25 -t 14:50:05
   ```

   In the above example, the date and time are included as examples only. Your values will be different. Use yyyyy/mm/dd for the date and a 24-hour clock for the time.

2. Type the following string to change the Management Port IP address and other settings, then press Enter.

   administrator@cli> **net -a mod -t mgmt -s "primaryip=192.168.1.129, primaryipmask=255.255.255.0, gateway=192.168.10.1"**

   In the above example, the IP addresses and subnet mask are included as examples only. Your values will be different. ***Note that the factory default IP address is 192.168.1.129***

   If you prefer to let your DHCP server assign the IP address, type the following string, then press Enter.

   administrator@cli> **net -a mod -t mgmt -s "dhcp=enable"**

   Note that the IP address described above belongs to the Galaxy 3G subsystem, not to the RAID controller. Use this IP address to log into the Galaxy 3G over your network.

3. To verify the settings, type **net** and press Enter.

   administrator@cli> **net**

   ```
   ============================================
   CId   Port Type  IP            Mask          Gateway       Link
   ============================================
   Virtual          Mgmt          192.168.1.129 255.255.255.0 192.168.10.1      Up
   ```

To see the full set of CLI commands, at the administrator@cli>> prompt, type **help** and press Enter.

3.4 Setting up Galaxy 3G with the CLU fig 3.3a

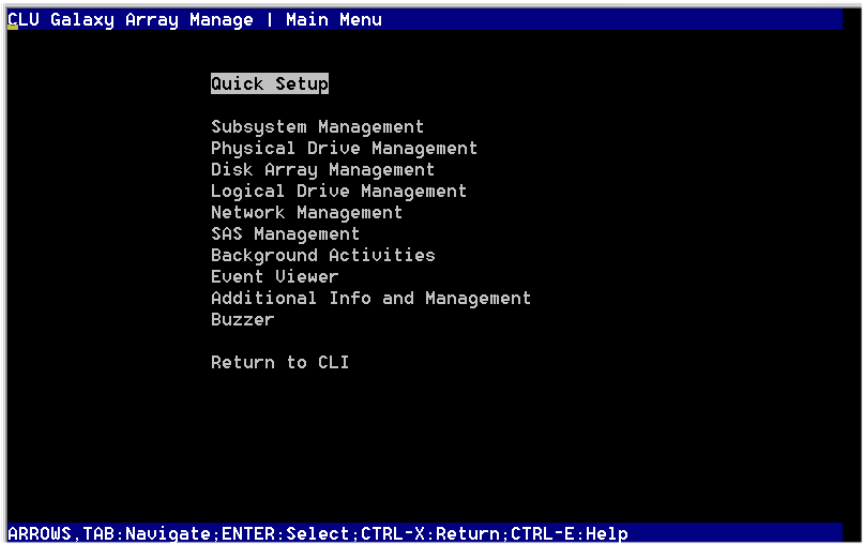
1. At the administrator@cli> prompt, type **menu** and press Enter.

   The CLU main menu appears.

2. With Quick Setup highlighted, press Enter.

   The first Quick Setup screen enables you to make Date and Time settings.

Fig 3.3a GAM main menu



Setting system date and time

1. Press the arrow keys to highlight System Date.
2. Press the backspace key to erase the current date.
3. Type the new date.
4. Follow the same procedure to set the System Time.
5. Press Ctrl-A to save these settings and move to the Management Port configuration screen.

Making Management Port settings

By default, DHCP is disabled on the Galaxy 3G and the default Management Port IP address is set to **198.168.1.129**

Note that the IP address described here belongs to the Galaxy 3G subsystem, not to the RAID controller. Use this IP address to log into the Galaxy 3G over your network.

Manual IP settings

To make Management Port settings manually:

1. Press the arrow keys to highlight IP Address.
2. Press the backspace key to erase the current IP Address.
3. Type the new IP Address.
4. Follow the same procedure to specify the Subnet Mask, Gateway IP Address and DNS Server IP Address. If you do not have a DNS server, skip the DNS Server IP address.
5. Press Ctrl-A to save your settings.

Automatic IP settings

To make Management Port settings automatically:

1. Press the arrow keys to highlight DHCP.
2. Press the spacebar to toggle to Enable.
3. Press Ctrl-A to save these settings.

Viewing IP address and settings

To view the current IP address and network settings when using DHCP:

1. Press the arrow keys to highlight DHCP.
2. Press the spacebar to toggle to Disable.
   The current Management Port settings are displayed.
3. Press the spacebar to toggle DHCP back to Enable.
4. Press Ctrl-A to save these settings and move to the RAID configuration screen.

Exiting the CLU

1. Highlight Skip the Step and Finish and press Enter.
2. Highlight Return to CLI and press Enter.

.

3.5 Creating Disk Arrays with the Galaxy Array Manager [GAM]

Note

You can also use the CLU to create disk arrays and logical drives. See Chapter 5 for more information.

Setting up disk arrays with GAM consists of the following actions:

- Logging into GAM (below)
- Selecting a Language
- Creating a Disk array
- Logging out of

- Using
- Obtaining a S

Logging into GAM fig 3.5a

1. Launch your Browser.
2. In the Browser address field, type in the IP address of the Galaxy 3G subsystem.

   Use the IP address you set in the CLI or CLU.. Note that the IP address shown below is only an example. The IP address you type into your browser could be different.

Regular Connection

- GAM uses an HTTP connection ..... .http://
- Enter the Galaxy 3G's Management Port IP address. 192.168.1.129

Together, your entry looks like this:

`http://192.168.1.129`

Secure Connection

- GAM uses a secure HTTP connection ..... .https://
- Enter the Galaxy 3G's Management Port IP address. 192.168.1.129

Together, your entry looks like this:

`https://192.168.1.129`

Note

Whether you select a regular or a secure connection, your login to GAM and your user password are always secure.

3. When the log-in screen (Figure 3.5a) appears:
   - Type **`administrator`** in the User Name field.
   - Type **`password`** in the Password field.
   - Click the **`Login`** button.

   The User Name and Password are case sensitive.
4. Click the **`Login`** button.

Fig 3.5a GAM Login screen

After sign-in, the GAM opening screen appears. If there are any un-configured physical drives in the enclosure, an Array Configuration menu will also appear (see Creating a Disk array).

Note

Make a Bookmark (Netscape Navigator) or set a Favorite (Internet Explorer) of the Login Screen so you can access it easily next time.

Selecting a Language fig3.5b

GAM displays in English, German, French, Italian, Japanese, Chinese Traditional, Chinese Simple, and Korean.

1. Click **Language** on the GAM Header.

   The language list appears in the Header.
2. Click on the language you prefer.

   The GAM user interface displays in the selected language.

Fig 3.5b GAM Language select

Creating a Disk Array fig 3.5c

Your Galaxy 3G subsystem will be pre-configured with arrays setup as you have instructed or by application default. If there is a reason to create a disk array follow this procedure:

1. Click on the Disk Arrays icon, then click on the Create tab.

   The Array Configuration menu appears. See Figure 3.5c.
2. Choose one of the options:
   - Automatic – Creates a new disk array based on a default set of parameters, including one logical drive. The number of unconfigured physical drives available determines the RAID level of the disk array and whether a spare drive is created. See Automatic
   - Express – Creates a new disk array based on the characteristics you specify. You can create multiple logical drives. However, all of the logical drives will be the same size and RAID level. See

     Express
   - Advanced – Enables you to directly specify all parameters for a new disk array and its logical drives. See Advanced .
3. Click the **Next** button.

Automatic

When you choose the Automatic option, the following parameters appear on the screen:

- **Disk Arrays** – The number of physical drives in the disk array, their ID numbers, configurable capacity, and the number of logical drives to be created
- **Logical Drives** – The ID number of the logical drive(s), their RAID level, capacity, and stripe size
- **Spare Drives** – The physical drive slot number of the dedicated hot spare assigned to this disk array. A hot spare drive is created for all RAID levels except RAID 0, when five or more unconfigured physical drives are available

If you accept these parameters, click the **Submit** button. The new disk array appears in the Disk Array List on the Information tab.

If you do NOT accept these parameters, use the Express or Advanced option to create your disk array.

Express

When you choose the Express option, a set of characteristics and options appears on the screen.

1. Check the boxes to select any one or a combination of:
   - **Redundancy** – The array will remain available if a physical drive fails

- **Capacity** – The greatest possible amount of data capacity
- **Performance** – The highest possible read/write speed
- **Spare Drive** – A hot spare drive is created when you select Redundancy, Spare Drive, and five or more unconfigured physical drives are available

2. In the Number of Logical Drives field, enter the number of logical drives you want to make from this disk array.

   The maximum possible number of logical drives appears to the right of this field.

3. From the Application Type menu, select an application that best describes your intended use for this disk array:
   - File Server
   - Video Stream
   - Transaction Data
   - Transaction Log
   - Other

4. Click the **Update** button.

   Or check the Automatic Update box and updates will occur automatically.

   The following parameters display:
   - **Disk Arrays** – The number of physical drives in the disk array, their ID numbers, configurable capacity, and the number of logical drives to be created
   - **Logical Drives** – The ID number of the logical drive(s), their RAID level, capacity, and stripe size
   - **Spare Drives** – The physical drive ID number of the dedicated hot spare assigned to this disk array (all RAID levels except RAID 0)

   If you accept these parameters, proceed to the next step.

   If you do NOT accept these parameters, review and modify your selections in the previous steps.

5. When you are done, click the **Submit** button.

   The new disk array appears in the Disk Array List on the Information tab.

Advanced

Note

For an explanation of the parameters under the Advanced option, see “Chapter 7: Technology Background”

When you choose the Advanced option, the Step 1 – Disk Array Creation screen displays.

Step 1 – Disk Array Creation

1. Enter a name for the disk array in the field provided.
2. Check the box if you want to enable Media Patrol.

   For more information, see “Media Patrol” .
3. Check the box if you want to enable PDM.

   For more information, see “Predictive Data Migration (PDM)”.
4. Highlight the physical drives you want in the disk array from the Available list and press the **>>** button to move them to the Selected list.

   You can also double-click them to move them.
5. When you are done, click the **Next** button.

Step 2 – Logical Drive Creation

Logical Drive Creation enables you to specify logical drives under the new disk array. Enter the information for a logical drive, then click the **Update** button. If there is free capacity remaining, you can specify another logical drive now or wait until later.

6. Enter an alias for the logical drive in the field provided.
7. Choose a RAID level for the logical drive from the dropdown menu.

   The choice of RAID levels depends on the number of physical drives you selected.
8. RAID 50 and 60 only – Specify the number of axles for your array.

   For more information on axles, see “RAID 50 Axles” or “RAID 60 Axles” in Chapter 7.
9. Specify a Capacity and the unit of measure (MB, GB, TB).

   This value will be the data capacity of the first logical drive in your new disk array. If you specify less than disk array's maximum capacity, the remainder will be available for additional logical drives which you can create later.
10. Specify a Stripe size from the dropdown menu.

    64 KB, 128 KB, 256 KB, and 1 MB are available. 64 KB is the default.
11. Specify a Sector size from the dropdown menu.

    512 B, 1 KB, 2 KB, and 4 KB are available. 512 B is the default.
12. Specify a Read (cache) Policy from the dropdown menu.

    Read Cache, Read Ahead Cache, and No Cache are available. Read Ahead is the default.
13. Specify a Write (cache) Policy from the dropdown menu.

    Write Back and Write Through (Thru) are available. Write Back is the default.
14. From the Preferred Controller ID dropdown menu, select a controller.

    The choices are Controller 1 or 2, or Automatic. This feature is only available on subsystems with two controllers and LUN Affinity enabled.
15. Click the **Update** button.

    A new logical drive is displayed under New Logical Drives.

Repeat the above steps to specify additional logical drives as desired.

16. When you are done specifying logical drives, click the **Next** button.

Step 3 – Summary

The Summary lists the disk array and logical drive information you specified.

1. To proceed with disk array and logical drive creation, click the **Submit** button.

Logging out of GAM

There are two ways to log out of GAM:

- Close your browser window
- Click **Logout** on the GAM banner

Fig 3.5c GAM Logout selection

Clicking **Logout** brings you back to the Login Screen. See **Error! Reference source not found.**.

After logging out, you must enter your user name and password in order to log in again.

Using GAM over the Internet

The above instructions cover connections between Galaxy 3G and your company network. It is also possible to connect to a Galaxy 3G from the Internet.

Your MIS Administrator can tell you how to access your network from outside the firewall. Once you are logged onto the network, you can access the Galaxy 3G using its IP address.

While only a Fibre Channel or SAS-capable PC can read and write data to the logical drives on the Galaxy 3G, other PCs can monitor the Galaxy 3G from virtually any location.

Obtaining a Security Certificate

The Galaxy 3G has a default security certificate for the web server as well as for internal data communication. However, in most cases it is better to install and verify your own certificate. And, if possible, verify your certificate through a certificate authority, such as Verisign or Thwate. See your MIS Administrator for guidance.

To download your security certificate to GAM, see “Making Web Server Settings” .

Section 4
Management with GAM

4.0 Management with GAM

This chapter covers the following topics:

- 4.1 Logging into GAM
- 4.2 Selecting a Language
- 4.3 Perusing the Interface
- 4.4 Logging out of GAM
- 4.5 Working with the Storage Network
- 4.6 Working with Subsystems
- 4.7 Managing Users
- 4.8 Managing the Network Connection
- 4.9 Managing Fibre Channel Connections
- 4.10 Managing SAS Connections
- 4.11 Managing Storage Services
- 4.12 Managing Software Services
- 4.13 Exporting the User Database
- 4.14 Importing a User Database
- 4.15 Updating the Firmware
- 4.16 Restoring Factory Defaults
- 4.17 Clearing Statistics
- 4.18 Shutting Down the Subsystem
- 4.19 Restarting the Subsystem
- 4.20 Managing Controllers
- 4.21 Managing Enclosures
- 4.22 Managing Physical Drives
- 4.23 Managing Disk Arrays
- 4.24 Managing Logical Drives
- 4.25 Managing Spare Drives
- 4.26 Working with the Logical Drive Summary

4.1 Logging into GAM fig 4.1a

In order to log into GAM, you must first setup a network connection between your Host PC and the Galaxy3G subsystem, as described in “Chapter 3: Galaxy3G Setup”.

To log into GAM:

1. Launch your Browser.
2. In the Browser address field, type in the IP address of the Galaxy3G Management port.

   Note that the IIP address shown below is only an example. The IP address you type into your browser will be different.

Regular Connection

- GAM uses an HTTP connection ..... .http://
- Enter the Galaxy3G’s Management Port IP address .. 192.168.1.129

Together, your entry looks like this:

`http://192.168.1.129`

Secure Connection

- GAM uses a secure HTTP connection ..... .https://
- Enter the Galaxy3G’s Management Port IP address .. 192.168.1.129

Together, your entry looks like this:

https://192.168.1.129

Note

Whether you select a regular or a secure connection, your login to GAM and your user password are always secure.

3. When the log-in screen (Figure 1) appears:
   - Type **administrator** in the User Name field.
   - Type **password** in the Password field.
   - Click the **Login** button.

   The User Name and Password are case sensitive.
4. Click the **Login** button.

Fig 4.1a GAM Login screen

4.2 Selecting a Language fig 4.2a

GAM displays in English, German, French, Italian, Japanese, Chinese Traditional, Chinese Simple, and Korean.

1. Click **Language** the GAM Header.

   The language list appears in the Header.

2. Click the language you prefer.

   The GAM user interface displays in the selected language.

Fig 4.2a GAM Language select

4.3 Perusing the Interface

GAM is browser-based RAID management software with a graphic user interface.

There are four major parts to the graphic user interface:

- Header
- Tree
- Management View
- Event Frame

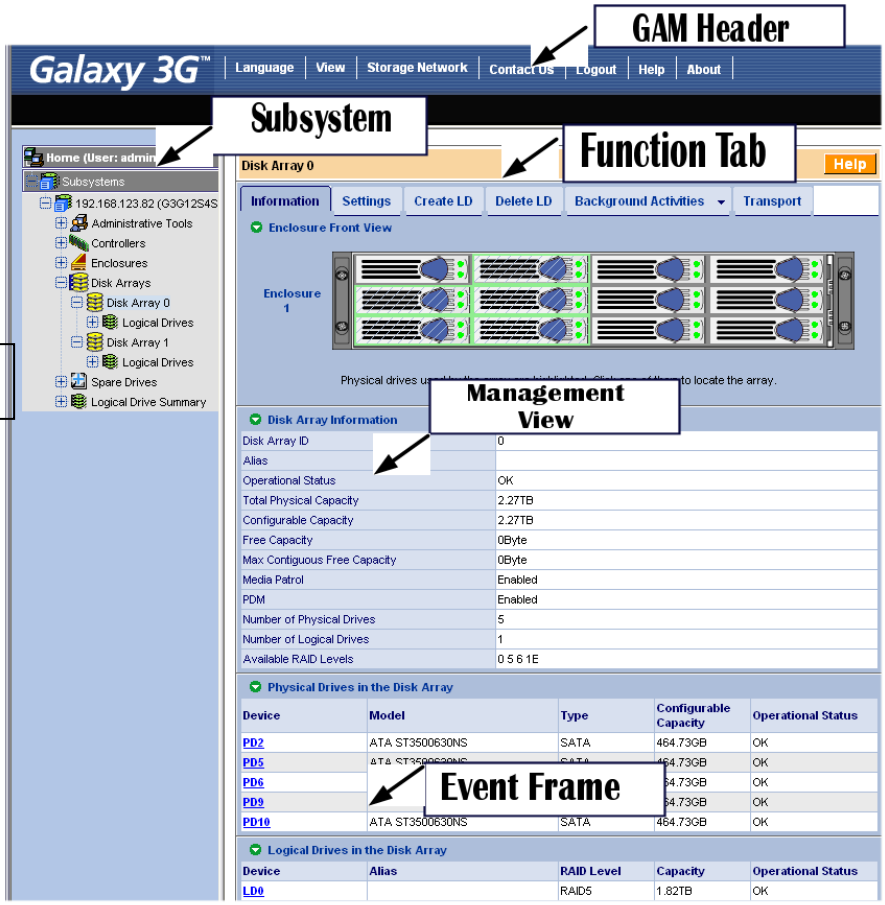


Fig 4.3a GAM GUI

Using the Header

The Header contains the following items:

- **Language** – To change languages, see

4.2 Selecting a L.

`View` **– To view the Event Frame, see Event Frame**

-
- **`Storage Network`** – To view all of the Galaxy3G subsystem enclosures currently accessible the network, see

4.5 Working with the S.

- **Contact Us** – Click on **Contact Us** for a list of contact information, including Technical Support. Also see “Contacting Technical Support”
- **Logout** – To logout of GAM, see

4.4 Logging out of

- **Help** – Click on **Help** in the Header to access the main online help menu.
- **About** – Click on About in the Header to display the GAM software version and build date.

Using Tree View

Tree View enables you to navigate around all components of the Subsystem, including Fibre Channel or SAS management, network and service management, RAID controller, enclosure, physical drives, disk arrays, logical drives, and spare drives. The figure below shows the components of Tree View.

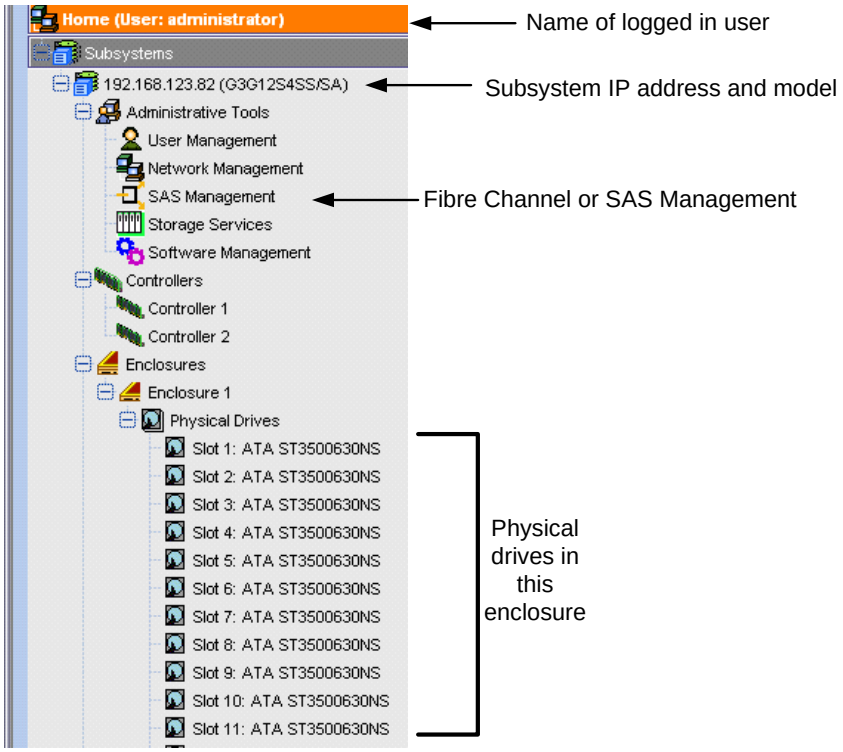


Fig 4.3b GAM Tree view information

The Administrative Tools section is different for the Super User than for other users. The remainder of the Tree is the same for all users.

Management View displays information according to the item you select in Tree View.

Using Management View

Management View provides the actual user interface with the Galaxy3G, including creation, maintenance, deletion, and monitoring of disk arrays and logical drives.

Function Tabs control specific actions and processes. This window changes depending on which item you select in Tree View and which tab you select in Management View itself.

Click the **Help** button in Management View to access online help for the function that is currently displayed.

Viewing the Event Frame

To view the Event Frame:

1. Click on View in the Header.
2. Click the Show Event Frame popup option.

   The Galaxy3G user interface will display the Event Frame below Management View.
3. Click View again to hide the Event Frame.

In the event frame, events are listed and sorted by:

- Item Number – A consecutive decimal number assigned to a specific event
- Device – Battery, controller, logical drive, physical drive, port, etc.
- Event ID – The hexadecimal number that identifies the specific type of event
- Severity – Information, Warning, Minor, Major, Critical, and Fatal. The severity level is user-specified. See Setting-up User E
- Time – Time and date of the occurrence
- Description – A brief description of the event

Sorting Events

You can sort the events by Item Number, Device, Event ID, Severity, Time and Date, or Description.

Click on the link at the top of the column by which you want to sort the events. After you click on the item, a triangle icon appears.

- If the triangle points upward, the column is sorted low-to-high or old-to-new.
- If the triangle points downward, the column is sorted high-to-low or new-to-old.

Click the link a second time to change to flip the triangle and reverse the sort sequence.

4.4 Logging out of GAM fig 4.4a

There are two ways to log out of GAM:

- Close your browser window
- Click Logout the GAM banner (below

Fig 4.4a GAM Logout selection

Clicking **Logout** brings you back to the Login Screen. After logging out, you must enter your user name and password in order to log in again.

4.5 Working with the Storage Network

When you log into GAM, you access a specific Galaxy3G subsystem. See 4.1 Logging into GAM fig 4.1a

..

The Storage Network feature enables you to access all of the Galaxy3G subsytems with a Management Port connection to your network.

Each Galaxy3G subsystem is identified by its Management Port IP address.

Storage Network functions include:

- Viewing other subsystems
- Updating the list of subsystems
- Logging into a subsystem
- Hiding the other subsystems

Viewing Other Subsytems

To view the other Galaxy3G subsytems in the Storage Network:

1. Click on **`Storage Network`** in the Header.
2. Click the *Show Network Subsystems* popup option.

   The list will show all subsystems the network at the time the GUI was launched.

Updating the List of Subsystems

To update the list of the Galaxy3G subsytems in the Storage Network:

Click the **`Discover`** button at the bottom of the subsystem list.

Logging into a Subsystem

To log into any of the displayed Galaxy3G subsystems:

1. In Tree View, click the Subsystem icon of the subsystem you want to see.

   If your user name and password do not match the subsystem you are logging into, the log in screen will appear.
2. Log into the new subsystem, as needed.

Hiding the Other Subsystems

To hide the other Galaxy3G subsystems the Storage Network:

1. Click on **`Storage Network`** in the Header.
2. Click the *Hide Network Subsystems* popup option.

4.6 Working with Subsystems

A Galaxy3G subsystem is identified by its Management Port IP address. Subsystem functions include:

- Viewing S
- Setting an Alias for the S
- Setting Redundancy for the S
- Setting S
- Viewing the R
- Saving the Runtime E
- Clearing the Runtime E
- Viewing NVRAM Events
- Saving NVRAM E
- Clearing NVRAM E
- Viewing Current B
- Making B
- Running B
- Running M
- Running P
- Viewing S
- Scheduling an A
- Deleting a S
- Viewing L
- Setting the L
- Renewing the L
- Releasing the L

Viewing Subsystem Information

To view information about a subsystem, click the Subsystem icon in Tree View. Management View displays the subsystem information.

Setting an Alias for the Subsystem

An alias is optional. To set an alias for this subsystem:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Settings tab.
3. Enter a name into the Alias field.

   Maximum of 48 characters. Use letters, numbers, space between words, and underscore.
4. Click the **Submit** button.

Setting Redundancy for the Subsystem

To set redundancy for this subsystem:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Settings tab.
3. In the Redundancy Type dropdown menu, select:
   - Active-Active – Both RAID controllers are active and can share the load
   - Active-Standby – One RAID controller is in standby mode and goes active if the other fails

4. Click the **Submit** button.

If you change Redundancy Type, be sure both controllers are properly installed in the subsystem before you restart.

If your subsystem has dual controllers and they are set to Active-Active, you can use the LUN Affinity feature. See Making Controller S

Setting Subsystem Date and Time

To set a Date and Time for this subsystem:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Settings tab dropdown menu and select *Date and Time* Settings.
3. Under Subsystem Date, select the Month and Day from the dropdown menus.
4. Type the current year into the Year field.
5. Under Subsystem Time, select the Hour, Minutes and Seconds from the dropdown menus.
6. Click the **Submit** button.

Viewing the Runtime Event Log

Runtime Events lists information about the 1023 most recent runtime events recorded since the system was started. To view runtime events:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Events tab dropdown menu and select *Runtime Events*.

   Events are displayed by:
   - **Item Number** – A consecutive decimal number assigned to a specific event
   - **Device** – Battery, controller, logical drive, physical drive, port, etc.
   - **Event ID** – The hexadecimal number that identifies the specific type of event
   - **Severity** – Information, Warning, Minor, Major, Critical, and Fatal. The severity level is user-specified. See Setting-up User E.
   - **Time** – Time and date of the occurrence
   - **Description** – A brief description of the event
3. Click on the link at the top of the column by which you want to sort the events. After you click on the item, a triangle icon appears.
   - If the triangle points upward, the column is sorted low-to-high or old-to-new.
   - If the triangle points downward, the column is sorted high-to-low or new-to-old.

   Click the link a second time to change to flip the triangle and reverse the sort sequence.

Saving the Runtime Event Log

To save the runtime event log as a text file:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Events tab dropdown menu and select *Runtime Events*.
3. Click the **Save Event Log** button.
4. In the File Download dialog box, click the **Save** button.
5. In the Save dialog box, name the file, navigate to the folder where you want to save the log file, and click the **Save** button.

Clearing the Runtime Event Log

To clear the runtime event log:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Events tab dropdown menu and select *Runtime Events*.

3. Click the **Clear Event Log** button.
4. In the Confirmation dialog box, type **confirm** and click the **OK** button.

Viewing NVRAM Events

NVRAM Events lists information about the 63 most recent important events. NVRAM events are stored in non-volatile memory. To view runtime events:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Events tab dropdown menu and select System Events in NVRAM.

   Events are displayed by:

   - **Item Number** – A consecutive decimal number assigned to a specific event
   - **Device** – Battery, controller, logical drive, physical drive, port, etc.
   - **Event ID** – The hexadecimal number that identifies the specific type of event
   - **Severity** – Information, Warning, Minor, Major, Critical, and Fatal. The severity level is user-specified. See Setting-up User E.
   - **Time** – Time and date of the occurrence
   - **Description** – A brief description of the event

3. Click on the link at the top of the column by which you want to sort the events. After you click on the item, a triangle icon appears.
   - If the triangle points upward, the column is sorted low-to-high or old-to-new.
   - If the triangle points downward, the column is sorted high-to-low or new-to-old.

   Click the link a second time to change to flip the triangle and reverse the sort sequence.

Saving NVRAM Events

To save the NVRAM event log as a text file:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Events tab dropdown menu and select System Events in NVRAM.
3. Click the **Save Event Log** button.
4. In the File Download dialog box, click the **Save** button.
5. In the Save dialog box, name the file, navigate to the folder where you want to save the log file, and click the **Save** button.

Clearing NVRAM Events

To clear the NVRAM event log:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Events tab dropdown menu and select System Events in NVRAM.
3. Click the **Clear Event Log** button.
4. In the Confirmation dialog box, type **confirm** and click the **OK** button.

Viewing Current Background Activities

To view the current background activities:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Background Activities tab.

   A list of current background activities appears, including:

   - Rebuild
   - PDM – Predictive Data Migration
   - Synchronization
   - Redundancy Check

- Migration
- Transition
- Initialization
- Media Patrol

Making Background Activity Settings

To make settings for background activities:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Background Activities tab and select Settings from the dropdown menu.
3. Click the dropdown menu to choose a priority of Low, Medium, and High for the following functions:
   - Rebuild – Rebuilds the data from a failed drive in a disk array
   - Synchronization – Checks the data integrity on disk arrays
   - Initialization – Sets all data bits in the logical drive to zero
   - Redundancy Check – Checks, reports and can correct data inconsistencies in logical drives
   - Migration – Change RAID level or add physical dries to disk arrays
   - PDM – Looks for bad blocks the physical drives of disk arrays
   - Transition – Returns a revertible spare drive to spare status

   The rates are defined as follows:
   - Low – Fewer resources to activity, more to data read/write.
   - Medium – Balance of resources to activity and data read/write.
   - High – More resources to activity, fewer to data read/write.
4. Highlight the following PDM trigger settings and type a value into the corresponding field:
   - Reassigned Block Threshold – 1 to 512 blocks
   - Error Block Threshold – 1 to 1024 blocks
5. Check to enable or uncheck to disable the following functions:
   - Media Patrol – Checks the magnetic media on physical drives
   - Auto Rebuild – If there is a spare drive of adequate capacity, a critical disk array will begin to rebuild automatically. If not spare drive is available, the disk array will begin to rebuild as soon as you replace the failed physical drive with an unconfigured physical drive of equal or greater size.
6. Click the **Submit** button to save your settings

Running Background Activities

To run a background activity from the Background Activities tab:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Background Activities tab and select one of the following from the dropdown menu.
   - Media Patrol – See Running M
   - Rebuild – See Rebuilding a D
   - PDM – See Running P
   - Transition – See Transitioning a D
   - Initialization – See Initializing a L
   - Redundancy Check – See Running R
3. In the next screen, make the choices as requested.

4. Click the **Start** button.

Running Media Patrol

Media Patrol checks the magnetic media on physical drives. When it finds the specified number of bad blocks, it will trigger PDM. See Making B and Running P.

You can schedule Media Patrol to run automatically, see Scheduling an A.

To run Media Patrol:

1. In Tree View, click the Subsystem icon.
2. From the dropdown menu on the Background Activities tab, select Start Media Patrol.
3. In the next screen, click the **Start** button.

Running PDM

Predictive Data Migration (PDM) migrates data from the suspect physical drive to a spare disk drive, similar to Rebuilding. But unlike Rebuilding, PDM acts before the disk drive fails and your Logical Drive goes Critical.

You an also run PDM on a specific disk array, see Running PDM on a D

Also see “Predictive Data Migration (PDM)”

To run PDM:

1. In Tree View, click the Subsystem icon.
2. In Management View, click the Background Activities tab and select Start Media Patrol from the dropdown menu.
3. In the next screen, select the Source and Target physical drives.

   The suspect physical drive is the source. The replacement physical drive is the target.
4. Click the **Start** button.

Viewing Scheduled Activities

To view scheduled activities for this subsystem:

1. Click the Subsystem icon Tree View.
2. Click the Scheduler tab in Management View.

Scheduling an Activity

To set a scheduled activity for this subsystem:

1. Click the Subsystem icon Tree View.
2. From the dropdown menu on the Scheduler tab, choose an item:
   - Media Patrol. See Running M
   - Redundancy Check. See Running R
   - Battery Reconditioning. See Reconditioning a B
   - Spare Drive Check. See Running S
3. In the Scheduler dialog box, check the Enable This Schedule box.
4. Select a start time (24-hour clock).
5. Select a Recurrence Pattern.
   - Daily – Enter the number of days between events.
   - Weekly – Enter the number of weeks between events and select which days of the week.
   - Monthly – Select a calendar day of the month (1 – 31).

   If you select a higher number than there are days in the current month, the actual start date will occur at the beginning of the following month.

Or, select a day of the week and select the first, second, third, fourth, or last occurrence of that day in the month.

Then, select the months in which you want the activity to occur.

6. Select a Range of Occurrence.
   - Start-from date. The default is today's date.
   - End-on date.

   Select No End Date (perpetual).

   Or, select a number of occurrences for this activity.

   Or, select a specific end date. The default is today's date.
7. For Redundancy Check only:
   - Choose the Auto Fix option. This feature attempts to repair the problem when it finds an error.
   - Choose the Pause on Error option. This feature stops the process when it finds an error
   - Check the boxes beside the logical drives (all except RAID 0) to which this activity will apply.

     Each logical drive can have only one scheduled Redundancy Check.
8. Click the **Submit** button.

Note

You can schedule only ONE Redundancy Check for each logical drive.

Deleting a Scheduled Activity

To delete a scheduled activity for this subsystem:

1. Click the Subsystem icon Tree View.
2. From the dropdown menu on the Scheduler tab, choose Delete Schedules.
3. Check the box to the left of the schedule you want to delete.
4. Click the **Submit** button.

Viewing Lock Status

The lock prevents other sessions (including by the same user) from making a configuration change to the controller until the lock expires or a forced unlock is done.

To view the lock status for this subsystem:

1. Click the Subsystem icon Tree View.
2. Click the Lock tab in Management View.

   The following information is displayed:
   - Lock Status – The User who set (owns) the current lock.
   - Expiration Time – Amount of time left until the lock automatically releases.
   - Expire At Time – The date and time when the lock will automatically release.

Setting the Lock

The lock prevents other sessions (including by the same user) from making a configuration change to the controller until the lock expires or a forced unlock is done.

You can set the lock to last from one minute to one day. To set the lock for this subsystem:

1. Click the Subsystem icon Tree View.
2. Click the Lock tab in Management View.

3. Click the **Lock** option.
4. Enter a time interval between 1 and 1440 minutes (one day) that you want the lock to stay active.
5. Click the **Submit** button.

Renewing the Lock

The lock prevents other sessions (including by the same user) from making a configuration change to the controller until the lock expires or a forced unlock is done.

Renewing the lock extends the period of time the controller remains locked. To renew an existing lock for this subsystem:

1. Click the Subsystem icon Tree View.
2. Click the Lock tab in Management View.
3. Click the **Renew** option.
4. Enter a time interval between 1 and 1440 minutes (one day) that you want the lock to stay active.

   The renew time replaces the previous Expiration Time.
5. Click the **Submit** button.

Releasing the Lock

The lock prevents other sessions (including by the same user) from making a configuration change to the controller until the lock expires or a forced unlock is done.

When the user who locked the controller logs out, the lock is automatically released. You can also release the lock before the scheduled time.

To release the lock for this subsystem:

1. Click the Subsystem icon Tree View.
2. Click the Lock tab in Management View.

   If you are the User who set the lock, click the **Unlock** option.

   If another User set the lock and you are a Super User, click the **Unlock** option and check the **Force Unlock** box.
3. Click the **Submit** button.

4.7 Managing Users

User Management includes all functions dealing with user accounts. Functions include:

- Viewing User Information
- Making User Settings
- Making Your Own User Settings
- Setting-up User Event Subscriptions
- Changing Another User's Password
- Changing Your Own Password
- Creating a User
- Deleting a User (
- Viewing User Sessions
- Logging out Other Users

Viewing User Information

The view a list of users, their status, access privileges, display name, and email address:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the User Management icon.
   The Information tab appears in Management View.

Making User Settings

To change settings of other users:

1. Log into GAM as the Administrator or a Super User.
2. Click the Subsystem icon in Tree View.
3. Click the Administrative Tools icon.
4. Click the User Management icon.
5. On the Information tab, click the link of the user whose settings you want to change.
   The Settings screen for the selected user displays.
6. Make the following settings as needed.
   - Check the Enable box to enable this user.
   - Uncheck the box to disable this user.
   - Enter or change the display name.
   - Enter or change the email address.
   - From the Privilege dropdown menu, choose a new level.
     See List of U
7. Click the **Submit** button.

The Administrator or Super User can change another user's password. See Changing Another User's P for more information.

Making Your Own User Settings

To change your own user settings:

1. Log into GAM under your own user name.

2. Click the Subsystem icon in Tree View.
3. Click the Administrative Tools icon.
4. Click the User Management icon.
5. Click the Settings tab in Management View.
6. Enter or change the display name or mail address.
7. Click the **Submit** button.

Setting-up User Event Subscriptions

An event subscription enables a user to receive email messages about events taking place in the Galaxy3G subsystem. To make or change user event subscriptions:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the User Management icon.
4. Click the Event Subscription tab in Management View.
5. Check the box to enable event notification.
6. Under the subheadings, select the lowest level of Severity to be reported for each event. The selected level plus all higher levels of Severity will be reported.
   - Information – Information only, no action is required
   - Warning – User can decide whether or not action is required
   - Minor – Action is needed but the condition is not a serious at this time
   - Major – Action is needed now
   - Critical – Action is needed now and the implications of the condition are serious
   - Fatal – Non-Recoverable error or failure has occurred
   - None – Deactivates this event for notification purposes
7. Click the **Submit** button.

The user's account must have an email address. See Making U.

For information about the email service, see • Making Email Settings

- Making SLP Settings)
- Making Web Server Settings
- Making Telnet Settings
- Making SNMP Settings
- Making CIM Settings
- Making Netsend Settings

Making E

To send a test message to the email address in the listed under General Info, click the **Test Email** button.

Changing Another User's Password

To change a user's password:

1. Log into GAM as the Administrator or a Super User.
2. Click the Subsystem icon in Tree View.
3. Click the Administrative Tools icon.
4. Click the User Management icon.
5. In the list of users, click the link of the user whose settings you want to change.
   The Settings screen for the selected user displays.

6. Click the Password tab in Management View.
7. Enter the new password in the New Password field.
8. Enter the new password in the Retype Password field.
9. Click the **Submit** button.

Changing Your Own Password

To set or change your own password:

1. Log into GAM under your own user name.
2. Click the Subsystem icon in Tree View.
3. Click the Administrative Tools icon.
4. Click the User Management icon.
5. Click the Password tab in Management View.
6. Enter the current password in the Old Password field.

   If you do not have a password, leave this field blank.
7. Enter the new password in the New Password field.
8. Enter the new password in the Retype Password field.
9. Click the **Submit** button.

Creating a User

To create a user:

1. Log into GAM as the Administrator or a Super User.
2. Click the Subsystem icon in Tree View.
3. Click the Administrative Tools icon.
4. Click the User Management icon.
5. Click the Create tab in Management View.
6. Enter a user name in the User Name field.
7. Enter a password for this user in the New Password and Retype Password fields.

   A password is optional. If you do not specify a password, log into GAM with the User Name and leave the password field blank.
8. Enter a display name in the Display Name field.

   A display name is optional.
9. Enter the user's email address in the Email Address field.

   An email address is required in order to receive email event notification.

- Select a privilege level from the Privilege dropdown menu.

  For definitions of each privilege level, see the List of User Privileges below.

11. Check the Enabled box to enable this user on this subsystem.
12. Click the **Submit** button.

List of User Privileges

- **View** – Allows the user to see all status and settings but not to make any changes
- **Maintenance** – Allows the user to perform maintenance tasks including Rebuilding, PDM, Media Patrol, and Redundancy Check
- **Power** – Allows the user to create (but not delete) disk arrays and logical drives, change RAID levels, change stripe size; change settings of components such as disk arrays, logical drives, physical drives, and the controller.

- **Super** – Allows the user full access to all functions including create and delete users and changing the settings of other users, and delete disk arrays and logical drives. The default “administrator” account is a Super User.

Deleting a User

There will always be at least one Super User account. You cannot delete the user account you used to log in.

To delete a user:

1. Log into GAM as the Administrator or a Super User.
2. Click the Subsystem icon in Tree View.
3. Click the Administrative Tools icon.
4. Click the User Management icon.
5. Click the Delete tab in Management View.
6. Check the box to the left of the user you want to delete.
7. Click the **Submit** button.
8. Click **OK** in the confirmation box.

Viewing User Sessions

To view the current sessions:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the User Management icon.
4. Click the Sessions tab in Management View.

Logging out Other Users

To logout other users:

1. Log into GAM as the Administrator or a Super User.
2. Click the Subsystem icon in Tree View.
3. Click the Administrative Tools icon.
4. Click the User Management icon.
5. Click the Sessions tab in Management View.
6. Check the box to the left of the user you want to log out.
7. Click the **Logout** button.
8. Click **OK** in the confirmation box.

4.8 Managing the Network Connection

The network connection deals with network connections to the Galaxy3G's Management Ports. Functions include:

- Making S
- Making C

Making Subsystem Management Port Settings

The Galaxy3G subsystem has a virtual management port. When you log into the Galaxy3G over your network, you use the virtual management port. This arrangement enables you to log into a Galaxy3G with two controllers using one IP address.

Before you change settings, please see "Choosing DHCP or a Static IP Address"

To make changes to the Subsystem Management Port settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Network Management icon.
4. Click the **Port Configuration** link in Management View.
5. To enable DHCP, check the DHCP box.

   When DHCP is NOT enabled, enter:
   - Primary IP address
   - Primary subnet mask
   - Default gateway IP address
   - Enter a primary DNS server IP address.
6. Click the **Submit** button.

Making Controller Management Port Settings

The controller has an IP address for access when the controller goes into maintenance mode. Maintenance mode is only for remedial action in the event of a problem with the controller. See "Controller Enters Maintenance Mode"

To make changes to the Controller Management Port settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Network Management icon.
4. Click the Maintenance Mode tab in Management View.
5. Click the **Port Configuration** link for Controller 1 or 2.
6. To enable DHCP, check the DHCP box.

   When DHCP is NOT enabled, enter:
   - Primary IP address
   - Primary subnet mask
   - Default gateway IP address
   - Enter a primary DNS server IP address.
7. Click the **Submit** button.
8. Click the Maintenance Mode tab again.
9. Click the **Port Configuration** link for the other controller.

- To enable DHCP, check the DHCP box.

  When DHCP is NOT enabled, enter:

- Primary IP address
- Primary subnet mask
- Default gateway IP address
- Enter a primary DNS server IP address.

11. Click the **Submit** button.

4.9 Managing Fibre Channel Connections

This feature pertains to Galaxy3G Fibre Channel models. Functions include:

- Viewing Fibre Channel Node Information
- Viewing Fibre Channel Port Settings
- Making Fibre Channel Port Settings
- Viewing Fibre Channel Port Statistics
- Viewing SFP Information
- Viewing Fibre Channel Logged-in Devices
- Viewing Fibre Channel Initiators

Viewing Fibre Channel Node Information

To view Fibre Channel node information:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Fibre Channel Management icon.
4. Click the Node tab in Management View.

   The current node (data port) settings the Controller are shown, including:

   - WWNN – World Wide Node Name
   - Supported Features – Class of service
   - Maximum Frame Size – 2048 bits
   - Supported Speeds – 4 Gb/s, 2Gb/s, or 1 Gb/s

Viewing Fibre Channel Port Settings

To view the current Fibre Channel port settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Fibre Channel Management icon.
4. Click the Port tab in Management View

   The current data port settings the Controller are shown, including:

   - State – Online, Offline, Unknown
   - Port Identifier – A hexadecimal name for this port
   - Topology Attached – See the table below
   - Fabric WWNN – World Wide Node Name (appears when connected to a switch)
   - Fabric WWPN – World Wide Port Name (appears when connected to a switch)
   - Current Speed – 4 Gb/s, 2 Gb/s, or 1 Gb/s
   - Link Type – Long-wave laser, short-wave laser or electrical
   - Symbolic Name – A text name for this port
   - Link Speed* – 4 Gb/s, 2 Gb/s, 1 Gb/s, or Auto
   - Topology* – NL-Port, N-Port, or Auto
   - Hard ALPA* – Address can be 0 to 254. 255 means this feature is disabled
   - Alias WWPN

* Denotes items that you can change under Port Settings, below.

Making Fibre Channel Port Settings

To make Fibre Channel port settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Fibre Channel Management icon.
4. Click the Port tab in Management View
5. Click the **Port1** or **Port2** link in Management View.
7. Make the settings appropriate to your system. See

6. Port Setting Information
   - Configured Link Speed – 4 Gb/s, 2 Gb/s, 1 Gb/s or Auto (self-setting)
   - Configured Topology – N-Port (Point-to-Point), NL Port (Arbitrated Loop) or Auto (self-setting)
   - Hard ALPA – Address can be 0 to 254. 255 means this feature is disabled. An ALPA identifies a port in an arbitrated loop.
7. Click the **Submit** button to save your settings.

Port Setting Information

The table below shows the type of attached topology you will achieve based on your connection type and the configured topology you select.

Fibre Channel Attached Topology		
	Configured Topology	
Connection Type	N-Port	NL-Port
Switch	Fabric Direct	Public Loop
Direct	Point to Point	Private Loop

Example 1: If you connect the Galaxy3G to a Fibre Channel switch and select NL-Port topology, you will create a Public Loop attached topology.

Example 2: If you have a Point to Point attached topology, you made a direct connection (no switch) and selected N-port topology.

Note

In some cases, HBA settings to N-Port only work if connected to the switch. Refer to your HBA manual for more information.

Viewing Fibre Channel Port Statistics

To view statistics for the Fibre Channel ports:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Fibre Channel Management icon.
4. Click the Statistic tab in Management View.

The statistics for all Fibre Channel ports are shown.

Clearing Statistics

To clear statistics, see

4.17 Clearing S

Viewing SFP Information

SFPs (small form-factor pluggable) transceivers connect the ports the Galaxy3G controllers to the Fibre Channel fabric.

To view SFP information:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Fibre Channel Management icon.
4. Click the SFP tab in Management View.

   The SFP information for all Fibre Channel ports is shown.

SFP Information

- Connector – Type of connector
- Transceiver – SFP
- Transceiver Code – Defines the method to interpret the transceiver type and compatibility options
- Serial Encoding – Serial encoding algorithm
- Bit Rate – In gigabits per second
- Link Length – The maximum link length depending the type of fiber
- Vendor Name – Vendor name of the SFP transceiver
- Vendor OUI – Organizational Unique Identifier, SFP vendor's IEEE company ID
- Vendor Part Number
- Vendor Revision
- Vendor Serial Number
- Manufacturing Date – Code with 2 digits each for year, month, day, and optional vendor-specific lot number

Viewing Fibre Channel Logged-in Devices

To view a list of the devices currently logged into the Galaxy3G:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Fibre Channel Management icon.
4. Click the Logged In Device tab in Management View.

   One of the devices in the list will be the port itself. If there is no other device, this notification will appear: "There is no logged in device." If a Fibre Channel switch is attached, it will also appear in this list.

Viewing Fibre Channel Initiators

You must add an initiator to the Galaxy3G's initiator list in order to use the initiator to create a LUN for your logical drive.

To view a list of recognized initiators:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Fibre Channel Management icon.
4. Click the Initiator tab in Management View.

   A Fibre Channel switch will also display as an initiator in the list. If your Host PC's Fibre Channel HBA is connected to the Galaxy3G directly (not though a Fibre Channel switch), the initiator will NOT display in the initiator list.

Adding an Initiator

To add an initiator to the Galaxy3G's initiator list:

1. Check the box to the left of the initiator.
2. Click the **`Add to Initiator List`** button.

The initiator appears under Storage Services. You can then use the initiator to create a LUN. See Adding a L

4.10 Managing SAS Connections

This feature pertains to Galaxy3G Serial Attached SCSI models. Functions include:

- Viewing SAS Port Information
- Making SAS Port Settings
- Viewing SAS Port Statistics
- Viewing SAS Initiators

Viewing SAS Port Information

A SAS Controller can have one or two SAS channels. Each SAS channel has two ports:

- Host In or Data Port (a table-routed port)
- Host In/Out or Data Cascade Port (a subtractive-routed port)

See “Serial Attached SCSI” for information about how these ports are physically connected to the Host PC or other subsystems.

To view information about the SAS ports:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the SAS Management icon.

   The port information appears the screen.

   - Channel ID
   - Port Type
   - Link Status
   - Link Speed
   - SAS Address
   - Cable Signal Strength – Adjustable under Port Settings

See “Serial Attached SCSI” in chapter 1 for information about how these ports are physically connected to the Host PC or other subsystems.

Making SAS Port Settings

A SAS Controller can have one or two SAS channels. Each SAS channel has two ports:

- Host In or Data Port (a table-routed port)
- Host In/Out or Data Cascade Port (a subtractive-routed port)

To make settings to the SAS ports:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the SAS Management icon.
4. In Management View, click the **`Port 1`** or **`Port 2`** link.
5. From the Cable Signal Strength dropdown menu, choose a value.

   The range is 1 to 8. 1 is the default. Signal strength correlates to cable length in meters. Example: If you have a 2 m SAS cable, set signal strength to 2. If performance is unsatisfactory (see Viewing S), try settings of 1 and 3, then use the best setting for your system.
6. Click the **`Submit`** button.

Viewing SAS Port Statistics

The SAS Management Statistics tab displays statistical information about all of the SAS ports on the Galaxy3G subsystem.

To view information about the SAS ports:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the SAS Management icon.
4. In Management View, click the Statistic tab.

   The statistics for the selected port appear the screen.

Clearing Statistics

To clear statistics, see

4.17 Clearing S.

Viewing SAS Initiators

You must add an initiator to the Galaxy3G's initiator list in order to use the initiator to create a LUN for your logical drive.

To view a list of recognized initiators:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the SAS Management icon.
4. In Management View, click the Initiators tab.

   A list of all currently logged-in initiators appears the screen.

Adding an Initiator

To add an initiator to the Galaxy3G's initiator list:

1. Check the box to the left of the initiator.
2. Click the **`Add to Initiator List`** button.

The initiator appears under Storage Services. See Adding a L

4.11 Managing Storage Services

Storage services deal with initiators and LUN mapping for Fibre Channel models and for Serial Attached SCSI models. LUN masking is the process of applying a LUN Map so that each initiator can only access the LUNs specified for it.

Features include:

- Adding an Initiator
- Deleting an Initiator
- Viewing the LUN Map
- Enabling LUN Masking
- Adding a LUN Map
- Editing a LUN Map

Adding an Initiator

You must add an initiator to the Galaxy3G's initiator list in order to use the initiator to create a LUN

To add an initiator:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Storage Services icon.
4. Click the Initiators tab in Management View.
5. From the Initiators tab dropdown menu, select *Add Initiator*.
6. Enter the initiator's initiator's name in the Initiator Name field.
   - Fibre Channel – A Fibre Channel initiator name is the World Wide Port Name of the device and is composed of a series of eight, two-digit hexadecimal numbers.
   - SAS – A SAS initiator name is the SAS address of the HBA card in the Host PC. Obtain the initiator name from the initiator utility on your host system.

   Obtain the initiator name from the initiator utility on your host system.

   Note that the initiator name you input must match exactly in order for the connection to work.
7. Click the **`Submit`** button.

You can also add initiators from the Fibre Channel or SAS Initiators tab. See Viewing Fand Viewing S.

Deleting an Initiator

To delete an initiator:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Storage Services icon.
4. Click the Initiators tab in Management View.
5. From the Initiators tab dropdown menu, select *Delete Initiators*.
6. Check the box to the left of the initiator you want to delete.
7. Click the **`Submit`** button.

Viewing the LUN Map

To view the current LUN Map:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Storage Services icon.

4. Click the LUN Map tab in Management View.

Enabling LUN Masking

To enable the LUN Masking:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Storage Services icon.
4. Click the LUN Map tab in Management View.
5. Click the LUN Masking Enabled box.
6. Click the **Submit** button.

Adding a LUN Map

To edit the LUN Map:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Storage Services icon.
4. Click the LUN Map tab in Management View and from the dropdown menu, select Add a LUN Map.
5. Select an initiator from the Initiator dropdown list.
   Or enter the initiator's name in the Initiator Name field.
   Note that the initiator name you input must match exactly in order for the connection to work.
6. In the LUN Mapping & Masking list, enter the LUNs for each logical drive.
   You must enter different LUN numbers for each logical drive.
7. Click the **Submit** button.

Editing a LUN Map

To edit the LUN Map:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Storage Services icon.
4. Click the LUN Map tab in Management View.
5. From the LUN Mapping & Masking Information list, select an initiator and click on its link.
6. Select an initiator from the Initiator dropdown list.
   Or enter the initiator's name in the Initiator Name field.
   Note that the initiator name you input must match exactly in order for the connection to work.
7. In the LUN field, enter the LUNs for each logical drive.
   You must enter different LUN numbers for each logical drive.
8. Click the **Submit** button.

4.12 Managing Software Services

Software Services include the following functions:

- Making Email Settings
- Making SLP Settings)
- Making Web Server Settings
- Making Telnet Settings
- Making SNMP Settings
- Making CIM Settings
- Making Netsend Settings

Making Email Settings

The Email sends notification messages to users. See Setting-up User E.

To make Email service settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the **Email Setting** link in Management View.
4. Enter the IP address for your SMTP server.
5. Enter server port number for your SMTP server.
   25 is the default.
6. Select Yes to enable SMTP authentication or No to Yes.
7. If you selected Yes for SMTP authentication, enter a Username and Password in the fields provided.
8. Enter an Email sender address (example: RAIDmaster@mycompany.com).
9. Enter an Email subject (example: Galaxy3G Status).
- Click the **Submit** button.

Sending a Test Message

To send one test message to the User currently logged into GAM:

1. Under Test Email, check the “Send A Test Email” box.
2. Click the **Submit** button.

If you do not receive the Test Email message, see your Network Administrator for assistance with the mail server setup, email accounts, and other issues.

Changing the Startup Setting

1. Under Startup Type:
   - Click on the Automatic option to start the service automatically during system startup. Recommended.
   - Click on the Manual option to start the service manually (the service does not start during system startup).
2. Click on the **Submit** button.

Stopping Email service

To stop the Email service:

1. Click the **Stop** button.
2. Click **OK** in the confirmation box.

Starting or Restarting Email service

To start or restart the Email service, click the **Start** or **Restart** button.

Making SLP Settings

Galaxy3G's SLP service discovers services available over the Internet. To make SLP service settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click on the Software Management icon.
4. Click the **SLP** link.
5. Choose the Startup Type.
   - Click on the Automatic option to start the service automatically during system startup. Recommended.
   - Click on the Manual option to start the service manually (the service does not start during system startup).
6. Click the **Submit** button.

Stopping SLP service

To stop the SLP service:

1. Click the **Stop** button.
2. Click **OK** in the confirmation box.

Starting or Restarting SLP service

To start or restart the SLP service, click the **Start** or **Restart** button.

Making Web Server Settings

Galaxy3G's Web Server service connects the Galaxy3G GUI to the Galaxy3G subsystem though your browser.

To make Web Server settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the **Web Server Setting** link in Management View.
4. Enter the HTTP Port number.

   80 is the default.
5. Enter Session Time Out interval.

   This setting causes GAM to time-out after a period of inactivity. 24 minutes is the default. The range is 1 to 1440 minutes (one day).
6. If you want to use a secure connection, check the Enable SSL box.
7. If you checked the Enable SSL box, enter a HTTPS Port number.

   443 is the default.
8. If you want to download a SSL Certificate, check the Download Certificate box.
9. If you checked the Download Certificate box, enter the Certificate filename or click the Browse... button to locate it.

- Click the **Submit** button.

11. Click **OK** in the confirmation box to restart the Web Server service with your changes.

Changing the Startup Setting

1. Under Startup Type:
   - Click on the Automatic option to start the service automatically during system startup. Recommended.
   - Click on the Manual option to start the service manually (the service does not start during system startup).

2. Click on the **Submit** button.

Stopping Web Server service

To stop the Web Server service:

1. Click the **Stop** button.
2. Click **OK** in the confirmation box.

Starting or Restarting Web Server service

To start or restart the Web Server service, click the **Start** or **Restart** button.

Making Telnet Settings

Galaxy3G's Telnet service enables you to access Galaxy3G's Command Line Interface (CLI) through a network connection. To make Telnet settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the **Telnet Setting** link in Management View.
4. Enter the Telnet Port number.

   2300 is the default.
5. Enter the Maximum Number of Connections.

   4 is the default.
6. Enter the Session Time Out interval.

   24 minutes is the default.
7. Click the **Submit** button.
8. Click **OK** in the confirmation box to restart the Telnet service with your changes.

Changing the Startup Setting

1. Under Startup Type:
   - Click on the Automatic option to start the service automatically during system startup. Recommended.
   - Click on the Manual option to start the service manually (the service does not start during system startup).
2. Click on the **Submit** button.

Stopping Telnet service

To stop the Telnet service:

1. Click the **Stop** button.
2. Click **OK** in the confirmation box.

Starting or Restarting Telnet service

To start or restart the Telnet service, click the **Start** or **Restart** button.

Making SNMP Settings

Galaxy3G's SNMP service enables the SNMP browser to obtain information from the Galaxy3G. The Trap Sink is where SNMP events are sent and can be viewed.

To change the SNMP settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the **SNMP Management** link in Management View.
4. Enter the SNMP Port number.

   161 is the default.

5. Enter a System Name.
   There is no default name.
6. Enter a System Location.
   USA is the default.
7. Enter a System Contact (the email address of the administrator or other individual).
8. Enter the Read Community.
   Public is the default.
9. Enter the Write Community.
   Private is the default.
   To add a Trap Sink, see “Adding Trap Sinks” below.

- Click **OK** in the confirmation box to restart the SNMP service with your changes.

Adding Trap Sinks

To add a trap sink:

1. Enter a Trap Sink IP address.
2. Select a Trap Filter, select the lowest level of Severity to be reported for each event.
   See Setting-up User E for an explanation of the Severity levels.
3. Click the **Update** button.
   The new trap sink appears in the Trap Sinks list.
4. Click the **Submit** button.
5. Click **OK** in the confirmation box.

Deleting Trap Sinks

To delete a trap sink:

1. Highlight the trap sink you want to delete from the list.
2. Click the **Delete** button to remove the trap sink from the list.
3. Click the **Submit** button.
4. Click **OK** in the confirmation box.

Changing the Startup Setting

1. Under Startup Type:
   - Click on the Automatic option to start the service automatically during system startup. Recommended.
   - Click on the Manual option to start the service manually (the service does not start during system startup).
2. Click on the **Submit** button.

Stopping SNMP service

To stop the SNMP service:

1. Click the **Stop** button.
2. Click **OK** in the confirmation box.

Starting or Restarting SNMP service

To start or restart the SNMP service, click the **Start** or **Restart** button.

Making CIM Settings

Galaxy3G’s CIM (Common Information Model [a protocol]) service provides a database for information about computer systems and network devices.

To change the CIM settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the **CIM Setting** link in Management View.
4. Click the **Start** button to start the CIM service.
5. To enable CIM using a HTTP connection:
   - Choose the Yes option
   - Enter a port number in the field provided (5988 is the default)
6. To enable CIM using a HTTPS connection:
   - Choose the Yes option
   - Enter a port number in the field provided (5989 is the default)
7. To enable authentication for your CIM connection(s):
   - Choose the Yes option
   - Enter the old password in the field provided (password is the default)
   - Enter a new password in the field provided

   To change your password, the CIM service must be running. See Starting or Restarting CIM service.

   There is only one user. The default name is “cim.” No changes are possible.
8. Click the **Submit** button.

Changing the Startup Setting

1. Under Startup Type:
   - Click on the Automatic option to start the service automatically during system startup. Recommended.
   - Click on the Manual option to start the service manually (the service does not start during system startup).
2. Click on the **Submit** button.

Stopping CIM service

To stop the CIM service:

1. Click the **Stop** button.
2. Click **OK** in the confirmation box.

Starting or Restarting CIM service

To start or restart the CIM service, click the **Start** or **Restart** button.

Making Netsend Settings

Galaxy3G’s Netsend service sends Galaxy3G subsystem events in the form of text messages to your Host PC and other networked PCs. This service is normally Stopped and set to Manual start. See Netsend R.

To change the Netsend settings:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the **Netsend** link.
4. Click the **Start** button to start the Netsend service.
5. Click the **Submit** button.

Adding Netsend recipients

See Netsend R. To add a Netsent recipient:

1. In the Recipient Address field, type the IP address of the recipient PC.
2. Under Recipient filter, select the lowest level of Severity to be reported for each event.

See Setting-up User Efor an explanation of the Severity levels.

3. Click the **Update** button to add the new recipient to the list
4. Click the **Submit** button.
5. Click **OK** in the confirmation box.

Deleting Netsend Recipients

To delete a Netsend recipient:

1. Highlight the recipient you want to delete in the recipient list.
2. Click the **Delete** button to remove the recipient from the list.
3. Click the **Submit** button.
4. Click **OK** in the confirmation box.

Changing the Startup Setting

1. Under Startup Type:
   - Click on the Automatic option to start the service automatically during system startup. Recommended if you plan to use this feature.
   - Click on the Manual option to start the service manually (the service does not start during system startup). The default setting.
2. Click on the **Submit** button.

Stopping Netsend service

To stop the Netsend service:

1. Click the **Stop** button.
2. Click **OK** in the confirmation box.

Starting or Restarting Netsend service

To start or restart the Netsend service, click the **Start** or **Restart** button.

Netsend Requirements

In order to use Netsend:

- Netsend must be running the Galaxy3G
- You must provide the IP address for each recipient PC
- The Messenger service must be running on each recipient PC

If your Netsend and Messenger service settings are correct but the recipient PC does not receive event messages, check the recipient PC's Firewall settings. Refer to your OS documentation for more information.

4.13 Exporting the User Database

You can export the User Database file to share user information and settings among multiple Galaxy3G subsystems.

The Export action saves a text file a designated folder the Host PC. From there, you can import the User Database file to other Galaxy3G subsystems.

To export the User Database file:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the **Export** link in Management View.
4. Click the **Export** button.
5. In the Opening export dialog box, click the **Save to Disk** option.
6. Click the **OK** button.

   The user database file is saved to the Host PC from which you access GAM.

Note

The Encryption box is grayed out. Encryption is always enabled.

4.14 Importing a User Database

Caution

Do NOT use this function to update the Galaxy3G firmware.

The Software Management–Import tab enables you to import the User Database file from the Host PC's file system to the Galaxy3G subsystem. When you make user settings to one Galaxy3G, you can export the User Database file to the Host PC. From there, you can import the User Database file to other Galaxy3G s so that all have the same User information and settings.

To import the User Database file to this subsystem:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Software Management icon.
4. Click the Import tab.
5. Under the Type dropdown list, select *User Database*.
6. Enter the name of the file to be imported.

   Or, click the **`Browse...`** button to search for the file.

   Look for a file called `export`.
7. Click the **`Submit`** button.
8. Click the **`Next`** button.

   If the imported file is a valid user database, an warning will appear to inform you that it will overwrite the previous settings.
9. In the Warning box, click the **`OK`** button.

   This user settings are applied to this Galaxy3G subsystem.

Note

The Decryption box is grayed out. Decryption is always enabled.

4.15 Updating the Firmware

This procedure is covered in Chapter 6: Maintenance. See “Updating the Firmware in GAM” for instructions.

4.16 Restoring Factory Defaults

Galaxy3G includes a function to restore the default settings to its Firmware and Software settings.

Caution

The action of restoring default settings can disrupt your Galaxy3G functions. Use this feature only when necessary and apply only the settings that must reset to default in order to set them correctly.

To access the Restore Defaults feature:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
   The Administrative Tools list appears.
3. Click the **`Restore Factory Defaults`** link at the bottom of the list in Management View.
   The Restore Factory Defaults screen appears.
4. Check the Firmware and Software functions you want to restore to default settings.
5. Click the **`Submit`** button.
6. In the confirmation box, type the word **`confirm`** in the field provided.
7. Click the **`OK`** button.

The functions you selected will be automatically restored to their default settings.

4.17 Clearing Statistics

The Clear Statistics function clears statistical data on controllers, Fibre Channel ports, SAS ports, physical drives, and logical drives. To clear statistical data:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the **Clear Statistics** link.

   The Clear Statistics tab appears in Management View.
4. Click the **Submit** button.
5. In the confirmation box, type the word **confirm** in the field provided.
6. Click the **OK** button.

4.18 Shutting Down the Subsystem

You can only do part of this function in GAM. Additional action is required, as described below. To shutdown the subsystem:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Shutdown link in Management View.

   A Shutdown or Restart tab will appear.
4. On the Shutdown or Restart tab, select *Shutdown* from the dropdown menu.
5. Click the **Submit** button.
6. In the confirmation box, type the word **confirm** in the field provided.
7. Click the **OK** button.

   When the controller shuts down, your GAM connection will be lost.
8. Wait for no less than two minutes.
9. Manually turn off the power supply switches the back of the subsystem.

Monitoring the Shutdown

To monitor a shutdown, you must use the Command Line Interface (CLI) though a serial connection to the Galaxy3G.

At the “administrator@CLI>” prompt, type **shutdown -a shutdown**.

When the “Shutdown complete. It is now safe to power off the subsystem.” message appears, turn off the power supply switches.

4.19 Restarting the Subsystem

You can only do part of this function in GAM. Additional action is required, as described below. To restart the subsystem

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click the Shutdown link in Management View.

   A Shutdown or Restart tab will appear.
4. On the Shutdown or Restart tab, select `Restart` from the dropdown menu.
5. Click the **`Submit`** button.
6. In the warning box, click the **`OK`** button.
7. In the confirmation box, type the word **`confirm`** in the field provided.
8. Click the **`OK`** button.

   When the controller shuts down, your GAM connection will be lost.
9. Wait for two to three minutes.

- In your browser, log into GAM once again.

  If you cannot log in, wait for 30 seconds, and try again. Repeat until login is successful.

Monitoring the Restart

To monitor a restart, you must use the Command Line Interface (CLI) though a serial connection to the Galaxy3G.

At the “administrator@CLI>” prompt, type **`shutdown -a restart`**.

When the “Login:” prompt appears, the restart is finished.

4.20 Managing Controllers

The RAID controllers are the heart of the Galaxy3G subsystem. Galaxy3G models have one or two controllers. Management of Controllers includes the following functions:

- Viewing the Controllers
- Locating a Controller
- Viewing Controller Information
- Viewing Controller Statistics
- Making Controller Settings
- Clearing an Orphan Watermark

Viewing the Controllers

To view information about the controllers:

1. Click the Subsystem icon in Tree View.
2. Click the Controllers icon.

   The controller information appears under the Information tab in Management View. Controller information includes:

   - Controller ID (1 or 2)
   - Alias, if assigned
   - Model, if applicable
   - Status – OK means normal
   - Readiness Status – Active or Standby
   - Locate – Click on the button to locate the controller. See below

Galaxy3G subsystems with only one controller will always show that the second controller is “Missing.”

If your Galaxy3G subsystem has two controllers and one is “Missing,” see “Controller Enters Maintenance Mode” for more information.

Locating a Controller

To identify a specific controller in the Galaxy3G subsystem:

1. Click the Subsystem icon in Tree View.
2. Click the Controllers icon.
3. In Management View, click the **`Locate Controller`** button.
4. The Controller Dirty Cache LED and Status LED, on the back of the Controller, will flash for one minute. See the illustrations below.

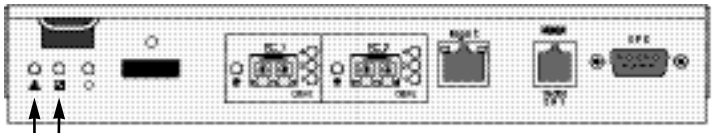


Fig 4.21a Galaxy 3G FC4 LEDs

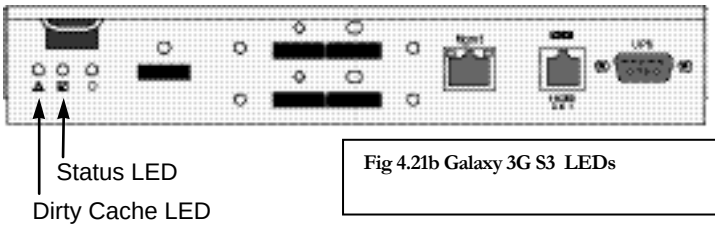


Fig 4.21b Galaxy 3G S3 LEDs

Viewing Controller Information

To view Controller information:

1. Click the Subsystem icon in Tree View.
2. Click the Controllers icon.
3. Click the Controller icon.

   The controller information appears the Information tab in Management View.

Adjustable items

You can set or adjust the following items:

- Alias, if assigned
- Coercion, enable or disable
- Coercion Method
- SMART – Self-Monitoring, Analysis, and Reporting System for physical drives.
- SMART Polling Interval
- Write Back Cache Flush Interval
- Enclosure Polling Interval
- LUN Affinity

See Making Controller S.

Upgradable items

You can upgrade the following items:

- Boot loader Version
- Firmware Version number
- Software Version number
- Memory Size

See “Chapter 6: Maintenance”

Viewing Controller Statistics

To view controller statistics:

1. Click the Subsystem icon in Tree View.
2. Click the Controllers icon.
3. Click the Controller icon.
4. Click the Information tab in Management View and select Statistics from dropdown menu.

Clearing Statistics

To clear statistics, see

4.17 Clearing S.

Making Controller Settings

To make Controller settings:

1. Click the Subsystem icon in Tree View.
2. Click the Controllers icon.
3. Click the Controller icon.
4. Click the Settings tab in Management View.
5. Make the following settings as needed:
   - Enter a name into the Alias field.

     Maximum of 48 characters. Use letters, numbers, space between words, and underscore. An alias is optional.
   - Fibre Channel models only. Check the Enable LUN affinity box to enable the LUN affinity feature.
   - Check the SMART Log box to enable the Self-Monitoring, Analysis, and Reporting System (SMART).
   - Enter a polling interval (1 to 1440 minutes) in SMART Polling Interval field.
   - Check the Coercion Enabled box to enable disk drive capacity coercion.

     When disk drives of different capacities are used in the same array, coercion reduces the usable capacity of the larger disk drive(s) in order to match the smallest capacity drive.

     For more information, see “Capacity Coercion” in chapter 7..
   - Select a coercion method from the Coercion Method dropdown menu. The choices are:

     `GB Truncate` – (Default) Reduces the useful capacity to the nearest 1,000,000,000 byte boundary.

     `10GB Truncate` – Reduces the useful capacity to the nearest 10,000,000,000 byte boundary.

     `Group Rounding` – Uses an algorithm to determine how much to truncate. Results in the maximum amount of usable drive capacity.

     `Table Rounding` – Applies a predefined table to determine how much to truncate.
   - Enter a time interval (1 to 12 seconds) in the Write Back Cache Flush Interval field.

     For more information, see “Cache Policy” in chapter 7..
   - Enter a time interval (15 to 255 seconds) in the Enclosure Polling Interval field.
   - Check the Adaptive Writeback Cache box to enable the Adaptive Writeback Cache feature.

     For more information, see “Adaptive Writeback Cache” in chapter 7.
6. Click the **`Submit`** button.

   The changes take effect immediately.

Clearing an Orphan Watermark

An Orphan Watermark condition is the result of a disk drive failure during an NVRAM RAID level migration on a disk array.

To clear an Orphan Watermark:

1. Click the Subsystem icon in Tree View.
2. Click the Controllers icon.
3. Click the Controller icon.
4. Click on the Clear tab in Management View.
5. Click the **`Submit`** button.

The changes take effect immediately. If your subsystem has two controllers, clearing a condition on one controller will automatically apply to the other controller.

4.21 Managing Enclosures

Galaxy3G enclosures include the main Galaxy3G subsystem or Head Unit as well as additional enclosures that are connected to it through cascading or expansion. Enclosure Management includes the following functions:

- Viewing the Enclosures
- Locating an Enclosure
- Viewing Enclosure Topology
- Viewing Enclosure Information
- Making Enclosure Settings
- Viewing FRU VPD Information
- Checking the Batteries
- Reconditioning a Battery
- Making Buzzer Settings
- Testing the Buzzer

Viewing the Enclosures

To view information about the enclosures:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.

   The following information is shown:

   - Enclosure ID number
   - Enclosure Type
   - Operational Status
   - Status Description – Specific components in need of attention, if any

Locating an Enclosure

To locate an enclosure (subsystem):

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the **Locate Enclosure** button.

   The Disk Status LEDs on the front of the enclosure will flash for one minute. See the illustrations below.

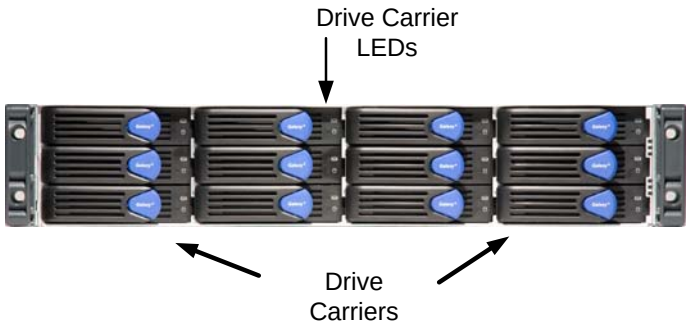


Fig 4.22a Galaxy 3G Carriers

Fig 4.22b Galaxy 3G Drive Carrier LED

Viewing Enclosure Topology

To view Enclosure Topology:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. click the Topology tab in Management View.

Enclosure topology refers to the manner in which the data paths among the enclosures are connected:

- Individual Subsystem
- JBOD Expansion – One Galaxy3G subsystem plus one or more JBOD expansion subsystems, managed through one subsystem or head unit
- RAID Subsystem Cascading – Multiple Galaxy3G subsystems, managed through one subsystem or head unit

The logical connections for these arrangements are shown the Enclosure Topology tab. The physical connections for these arrangements are discussed in “Chapter 2: Galaxy3G Installation” .

Viewing Enclosure Information

To view enclosure information:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.

   Enclosure information appears the Information tab in Management View. You can monitor power supplies, cooling units, enclosure temperatures and voltages, and the battery.

Adjustable items

You can set or adjust the following items:

- Enclosure Warning and Critical temperature thresholds
- Controller Warning and Critical temperature thresholds

See Making E.

For information on Enclosure problems, see “Chapter 8: Troubleshooting”.

Making Enclosure Settings

To make Enclosure settings:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Settings tab in Management View.
5. Enter a value in the following fields as necessary:
   - Enclosure Warning Temperature Threshold
   - Enclosure Critical Temperature Threshold
   - Controller Warning Temperature Threshold
   - Controller Critical Temperature Threshold
6. Click the **Submit** button.

   The changes take effect immediately.

Viewing FRU VPD Information

FRU VPD refers to Vital Product Data (VPD) information about Field Replaceable Units (FRU) in the enclosure. The number and type of FRU depends on the subsystem model.

To view FRU VPD information:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the FRU VPD tab in Management View.

Use this information when communicating with Technical Support and when ordering replacement units. For contact information, see “Contacting Technical Support” in Chapter 7.

Checking the Batteries

The Enclosure–Battery tab displays information about the cache backup battery (or batteries) in the Galaxy3G subsystem enclosure. To check the batteries:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Battery tab in Management View.

Battery Notes

Each battery works with a controller. If the battery is present in the subsystem but the corresponding controller is not present, the battery will not appear in the interface.

If a battery does not reflect normal conditions and it is not currently under reconditioning, run the Recondition function before you replace the battery. See Reconditioning a B.

During reconditioning, the battery is fully discharged then fully recharged. During that time, the controller cache is reset to Write Thru, unless the Adaptive Writeback Cache function is enabled. See Making Controller S.

If a battery reaches the threshold temperature while charging or discharging, the charge or discharge pauses and the blower runs at high speed until the battery temperature falls below the threshold.

If the battery does not maintain normal values after a Recondition, replace the battery. See “Replacing a Cache Battery” in Chapter 7.

Galaxy3G automatically reconditions the battery every two months. To set the schedule, see Scheduling an A.

When you install a new battery, the cycle count shows 0. Galaxy3G automatically runs a recondition on the battery to verify it. If you restart the subsystem or controller before reconditioning is finished, the battery is charged to 100%, then reconditioning starts again.

Reconditioning a Battery

To recondition the battery:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Battery tab in Management View.
5. From the Battery tab dropdown menu, select *Recondition*.
6. Click the **`Submit`** button.

   During reconditioning, Battery status can show “discharging” and “recharging”, and a value will display next to Current. During that time, the controller cache is reset to Write Thru. Reconditioning runs in the background and stops automatically upon completion.

   Galaxy3G automatically reconditions the battery every two months. To set the recondition schedule, see Scheduling an A.

Making Buzzer Settings

The buzzer sounds to inform you that the Galaxy3G needs attention. See “Galaxy3G is Beeping” in chapter 7 for more information.

To make buzzer settings:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Buzzer tab in Management View.
5. From the Buzzer tab dropdown menu, select *Settings*.
6. Check the Buzzer Enable box to enable the buzzer.

   Uncheck the Buzzer Enable box if you do not want the buzzer to sound.
7. Click the **Submit** button.

Testing the Buzzer

To test buzzer function:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Buzzer tab in Management View.
5. From the Buzzer tab dropdown menu, select *Settings*.
6. Check the Buzzer Enabled box.
7. Check the Test Buzzer box.
8. Click the **Submit** button.

   The buzzer will sound for one minute.

4.22 Managing Physical Drives

Managing Physical Drives deals with the physical disk drives installed in the Galaxy3G subsystem enclosure, including the following functions:

- Viewing a List of Physical Drives
- Identifying a Physical Drive
- Making Global Physical Drive Settings
- Viewing Physical Drive Information
- Viewing Physical Drive Statistics
- Making Physical Drive Settings
- Clearing Stale and PFA Conditions
- Forcing a Physical Drive Offline or Online

Viewing a List of Physical Drives

To view a list of physical drives in this enclosure:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Physical Drives icon.

   The list of physical drives appears in Management View.

Identifying a Physical Drive

To identify physical drive in the Galaxy3G subsystem enclosure:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Physical Drives icon.
5. In Management View, click the physical drives in the graphic.

   The location of the physical drive is highlighted in the Enclosure Front View diagram.

Making Global Physical Drive Settings

Global settings apply to all of the physical disk drives installed in the Galaxy3G subsystem enclosure. To make global physical drive settings:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Physical Drives icon.
5. Click the Global Settings tab in Management View.
6. Make the settings as needed.

   For SATA drives, check the boxes to enable:

   - Write Cache
   - Read Look Ahead Cache
   - Command Queuing (for disk drives that support Command Queuing)
   - From the DMA Mode dropdown menu, select a DMA mode.

   For SAS drives, check the boxes to enable:

   - Write Cache
   - Read Look Ahead Cache
   - Command Queuing (for disk drives that support Command Queuing)

- Read Cache

7. Click the **Submit** button.

   The functions you enable here depend on whether the physical drives support those functions. See Viewing P to determine which functions a particular drive supports.

Viewing Physical Drive Information

To view physical drive information:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Physical Drives icon.
5. Click on a Physical Drive icon.

Useful information provided here includes:

- The location of the physical drive is highlighted in the Enclosure Front View diagram.
- Operational Status – OK is normal. Can also show Rebuilding, Forced Online, Forced Offline, Transition Running, PDM Running, Media Patrol Running, Stale, PFA, Offline, or Dead.
- Configuration Status – The array to which the drive is assigned or its spare designation, including Unconfigured, Stale, PFA, Global Spare, Dedicated Spare, Revertible Global Spare, Revertible Dedicated Spare.

Adjustable Items

- Write Cache
- Read Look Ahead Cache
- Read Cache – SAS drive only
- Command Queuing
- DMA Mode – SATA drives only

See Making Global P.

Viewing Physical Drive Statistics

To view physical drive statistics:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Physical Drives icon.
5. Click on a Physical Drive icon.
6. From the dropdown menu on the Information tab, choose Statistics.

Clearing Statistics

To clear statistics, see

4.17 Clearing S.

Making Physical Drive Settings

An alias is the only setting you can make to an individual physical drive. All other settings are global. See Making Global P.

To make physical drive settings:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Physical Drives icon.
5. Click on a Physical Drive icon.
6. Click the Settings tab in Management View.
7. Type an alias into the Physical Drive Alias field.

   Maximum of 32 characters. Use letters, numbers, space between words, and underscore. An alias is optional.
8. Click the **Submit** button.

Clearing Stale and PFA Conditions

The Clear tab only appears when those conditions are present.

- Stale – The physical drive contains obsolete disk array information.
- PFA – The physical drive has errors resulting in a prediction of failure.

Be sure you have corrected the condition by a physical drive replacement, rebuild operation, etc., first. Then clear the condition. See “Physical Drive Problems” in chapter 7 for more information.

To clear a Stale or PFA status from a physical drive:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Physical Drives icon.
5. Click on a Physical Drive icon.
6. in Management View, click the Clear tab.
7. In the Confirmation box, click **OK** to confirm.

Note

If a physical drive has both a Stale and a PFA condition, click the Clear tab once to clear the Stale condition, then click again to clear the PFA condition.

Forcing a Physical Drive Offline or Online

The Physical Drive–Force Offline/Online tab enables you to force an:

- Online physical drive to go Offline
- Offline physical drive to go Online

The Force Offline/Online tab appears only for physical drives that are assigned to disk arrays.

Caution

Forcing a physical drive offline or online is likely to cause data loss. Back up your data before you proceed. Use these functions only when required.

Important

Forcing a physical drive offline will cause your logical drives to become degraded. If Auto Rebuild is enabled and a spare drive is available, the disk array will begin rebuilding itself automatically.

To force a physical drive offline or online:

1. Click the Subsystem icon in Tree View.
2. Click the Enclosures icon.
3. Click the Enclosure icon.
4. Click the Physical Drives icon.
5. Click on a Physical Drive icon.
6. Click the Force Offline/Online tab in Management View.
7. Click the **Submit** button.
8. In the confirmation box, type the word **confirm** in the field provided.
9. Click the **OK** button.

4.23 Managing Disk Arrays

Disk Array Management includes the following functions:

- Viewing Disk Arrays
- Creating a Disk Array
- Deleting a Disk Array
- Viewing Disk Array Information
- Making Disk Array Settings
- Creating a Logical Drive
- Deleting a Logical Drive)
- Migrating a Disk Array)
- Rebuilding a Disk Array
- Running PDM on a Disk Array
- Transitioning a Disk Array
- Preparing a Disk Array for Transport

Viewing Disk Arrays

To view the disk arrays in this enclosure plus any expanded or cascaded enclosures:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.

   A list of disk arrays appears in Management View.

   Click the **DA** link to view a specific disk array. See Viewing D

Creating a Disk Array

The CLU provides three methods of creating a disk array:

- **Automatic** – Creates a default disk array and logical drive based on unconfigured physical drives in the system. No user choices. See Creating a .
- **Express** – You select the RAID characteristics and type of application. Creates a disk array and logical drive(s) based on your input. See Creating a .
- **Advanced** – You specify all parameters for a new disk array. One logical drive will be made automatically when you create the disk array. If you select less than the total available capacity, you can use the remaining space to create additional logical drives at a later time. See Creating a Disk Array –

Creating a Disk Array – Automatic

The Disk Array Automatic Creation option enables you to create a new disk array following a default set of parameters. One logical drive will be made automatically when you create the disk array. To create a Disk Array using the Automatic function:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Create tab in Management View.
4. From the Create tab dropdown menu, select *Automatic*.

   The following parameters display:

   - **Disk Arrays** – The number of physical drives in the disk array, their slot numbers, configurable capacity, and the number of logical drives to be created
   - **Logical Drives** – The ID number of the logical drive(s), their RAID level, capacity, and stripe size

- **Spare Drives** – The physical drive slot number of the dedicated hot spare assigned to this disk array. A hot spare drive is created for all RAID levels except RAID 0, when five or more unconfigured physical drives are available

5. If you accept these parameters, click the **Submit** button.

   The new disk array appears in the Disk Array List the Information tab.

   If you do NOT accept these parameters, use the Advanced option to create your disk array.

Creating a Disk Array – Express

The Disk Array Express Creation option enables you to choose the parameters for a new disk array by specifying the characteristics you want. With this method, you can create multiple logical drives at the same time you create your disk array. However, all of the logical drives will be the same.

If you prefer to specific the parameters directly, use the Advanced option to create your disk array.

If you are uncertain about choosing parameters for your disk array, use the Automatic option.

To create a new disk array:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Create tab in Management View.
4. From the Create tab dropdown menu, select *Express*.
5. Check the boxes to select any one or combination of:
   - **Redundancy** – The array will remain available if a physical drive fails
   - **Capacity** – The greatest possible amount of data capacity
   - **Performance** – The highest possible read/write speed
   - **Spare Drive** – A hot spare drive is created when you select Redundancy, Spare Drive, and five or more unconfigured physical drives are available
6. In the Number of Logical Drives field, enter the number of logical drives you want to make from this disk array.
7. From the Application Type menu, select an application that best describes your intended use for this disk array:
   - File Server
   - Video Stream
   - Transaction Data
   - Transaction Log
   - Other
8. Click the **Update** button.

   Or check the Automatic Update box and updates will occur automatically.

   The following parameters display:
   - **Disk Arrays** – The number of physical drives in the disk array, their slot numbers, configurable capacity, and the number of logical drives to be created
   - **Logical Drives** – The slot number of the logical drive(s), their RAID level, capacity, and stripe size
   - **Spare Drives** – The physical drive slot number of the dedicated hot spare assigned to this disk array (all RAID levels except RAID 0)

   If you accept these parameters, proceed to the next step.

   If you do NOT accept these parameters, review and modify your selections in the previous steps.
9. When you are done, click the **Submit** button.

The new disk array appears in the Disk Array List the Information tab.

Creating a Disk Array –Advanced

The Disk Array Advanced Creation option enables you to directly specify all parameters for a new disk array. One logical drive will be made automatically when you create the disk array. If you select less than the total available capacity, you can use the remaining space to create additional logical drives at a later time.

If you are uncertain about choosing parameters for your disk array, use the Express or Automatic option to create your disk array.

To create a new disk array:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. From the Create tab dropdown menu, select *Advanced*.

Step 1 – Disk Array Creation

4. Enter an alias for the disk array in the field provided.
5. Check the box if you want to enable Media Patrol.

   For more information, see “Media Patrol” in chapter 7.
6. Check the box if you want to enable PDM.

   For more information, see “Predictive Data Migration (PDM)” in chapter 7.
7. Highlight physical drives you want in the disk array from the Available list and press the **>>** button to move them to the Selected list.

   You can also double-click them to move them.
8. When you are done, click the **Next** button.

Step 2 – Logical Drive Creation

Logical Drive Creation enables you to specify logical drives under the new disk array. Enter the information for a logical drive, then click the **Update** button. If there is free capacity remaining, you can specify another logical drive now or wait until later.

9. Enter an alias for the logical drive in the field provided.

- Choose a RAID level for the logical drive from the dropdown menu.

  The choice of RAID levels depends the number of physical drives you selected.

11. RAID 50 and 60 only – Specify the number of axles for your array.

    For more information on axles, see “RAID 50 Axles” or “RAID 60 Axles” in chapter 7.
12. Specify a Capacity and the unit of measure (MB, GB, TB).

    This value will be the data capacity of the first logical drive in your new disk array. If you specify less than disk array's maximum capacity, the remainder will be available for additional logical drives which you can create later.
13. Specify a Stripe size from the dropdown menu.

    64 KB, 128 KB, 256 KB, and 1 MB are available. 64 KB is the default.
14. Specify a Sector size from the dropdown menu.

    512 B, 1 KB, 2 KB, and 4 KB are available. 512 B is the default.
15. Specify a Read (cache) Policy from the dropdown menu.

    Read Cache, Read Ahead Cache, and No Cache are available. Read Ahead is the default.
16. Specify a Write (cache) Policy from the dropdown menu.

    Write Back and Write Through (Thru) are available. Write Back is the default.
17. From the Preferred Controller ID dropdown menu, select a controller.

    The choices are Controller 1 or 2, or Automatic. This feature is only available on subsystems with two controllers and LUN Affinity enabled.
18. Click the **Update** button.

A new logical drive is displayed under New Logical Drives.

Repeat the above steps to specify additional logical drives as desired.

19. When you are done specifying logical drives, click the **Next** button.

Step 3 – Summary

The Summary lists the disk array and logical drive information you specified.

1. To proceed with disk array and logical drive creation, click the **Submit** button.

The new disk array appears in the Disk Array List the Information tab.

Note

This function does not automatically create a hot spare drive. After the disk array is created, you can create a hot spare drive for it. For more information, see Creating a S

Deleting a Disk Array

The Disk Arrays–Delete tab enables you to delete existing disk arrays.

Caution

If you delete a disk array, you also delete any logical drives that belong to it, along with the data in those logical drives. Back up any important data before deleting a disk array.

To delete a disk array:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Delete tab in Management View.
4. Check the box to the left of the disk array you want to delete.
5. Click the **Submit** button.
6. In the confirmation box, type the word confirm in the field provided.
7. Click the **OK** button.

The selected disk array disappears from the Disk Array List the Information tab.

Viewing Disk Array Information

To view Disk Array information:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.

   The disk array information is shown in Management View.

Disk Array Operational Status

- OK – This is the normal state of a logical drive. When a logical drive is Functional, it is ready for immediate use. For RAID Levels other than RAID 0 (Striping), the logical drive has full redundancy.

- Synchronizing – This condition is temporary. Synchronizing is a maintenance function that verifies the integrity of data and redundancy in the logical drive. When a logical drive is Synchronizing, it will function and your data is available. However, access will be slower due to the synchronizing operation.
- Critical/Degraded – This condition arises as the result of a physical drive failure. A degraded logical drive will still function and your data is still available. However, the logical drive has lost redundancy (fault tolerance). You must determine the cause of the problem and correct it.
- Rebuilding – This condition is temporary. When a physical drive has been replaced, the logical drive automatically begins rebuilding in order to restore redundancy (fault tolerance). When a logical drive is rebuilding, it will function and your data is available. However, access will be slower due to the rebuilding operation.
- Transport Ready – After you perform a successful Prepare for Transport operation, this condition means you can remove the physical drives of this disk array and move them to another enclosure or different drive slots. After you relocate the physical drives, the disk array status will show OK.

Adjustable Items

- Alias – Optional.
- Media Patrol – Enabled or disabled.
- PDM – Enabled or disabled.

See Making D.

Making Disk Array Settings

To make Disk Array settings:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Settings tab in Management View.
5. Optional. Enter an alias in the Disk Array Alias field.

   Maximum of 32 characters. Use letters, numbers, space between words, and underscore. An alias is optional.
6. To enable Media Patrol support, check the Media Patrol box.
7. To enable PDM support, check the PDM box.
8. Click the **`Submit`** button.

Creating a Logical Drive

When you create a disk array, you automatically create one logical drive also. If the initial logical drive used less than the full capacity of the disk array, you can create additional logical drives from the same disk array.

To create a logical drive:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Create LD tab in Management View.
5. Enter an alias (name) in the Alias field.

   Maximum of 32 characters. Use letters, numbers, space between words, and underscore. An alias is optional.
6. From the RAID Level dropdown list, select a RAID level for this logical drive.

   All RAID levels supported by the disk array appear in the list. See “Choosing a RAID Level”.
7. RAID 50 and 60 only – Specify the number of axles for your array.

For more information on axles, see “RAID 50 Axles” or “RAID 60 Axles” in chapter 7.

8. Enter a capacity and select unit of measure (MB, GB, TB).

   The default value is the available capacity of the disk array. You can use this value or any lesser amount.

9. From the Stripe dropdown menu, select a Stripe size for this logical drive.

   The choices are 64 KB, 128 KB, 256 KB, 512 KB, and 1 MB. 64 KB is the default. See “Choosing Stripe Size” in chapter 7.

- From the Sector dropdown menu, select a Sector size for this logical drive.

  The choices are 512 B, 1 KB, 2 KB, and 4 KB. 512 B is the default. See “Choosing Sector Size” in chapter 7..

11. From the Read Policy dropdown menu, select a Read Cache policy for this logical drive.

    The choices are Read Cache, Read Ahead, and No (read) Cache. Read Ahead is the default. See “Cache Policy” in chapter 7.

12. From the Write Policy dropdown menu, select a Write Cache policy for this logical drive.

    The choices are Write Through (thru) and Write Back. Write Back is the default. If you selected No Cache under Read Cache, this setting will be Write Through. See “Cache Policy” in chapter 7.

13. From the Preferred Controller ID dropdown menu, select a controller.

    The choices are Controller 1 or 2, or Automatic. This feature is only available on subsystems with two controllers and LUN Affinity enabled.

14. Click the **`Update`** button to enter the logical drive parameters.
15. Review the results. If there is remaining space the disk array, you can create another logical drive, following the steps above. Each logical drive can have a different set of parameters.
16. Click the **`Next`** button when you are done.

    A new window displays with the disk array information and the proposed logical drives with their parameters.

17. Click the **`Submit`** button create the logical drives.

The new logical drive appears in the Logical Drive List the Information tab.

If you created a fault-tolerant logical drive (any RAID level except RAID 0), the Operational Status of new logical drive will display `Synchronizing` for several minutes after creation. You can use the logical drive during this period but read/write performance could be slower than normal.

Deleting a Logical Drive

Caution

All data on the logical drive will be lost. Back up any valuable data before deleting the logical drive.

To delete a logical drive:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Delete LD tab in Management View.
5. Check the box to the left of the logical drive you want to delete.
6. Click the **`Submit`** button.

   In the confirmation box, type the word **`confirm`** in the field provided.

7. Click the **OK** button.

The selected logical disappears from the Logical Drive List the Information tab.

Migrating a Disk Array

The action of migrating a disk array means either or both:

- Change the RAID Level
- Expand the storage capacity

For a list of Migration options and other important information, see “RAID Level Migration” .

Notes

- You can add physical drives to a RAID 50 or RAID 60 array but you cannot change the number of axles.
- If you add an odd number of physical drives to a RAID 10 array, it will become a RAID 1E array by default.

To Migrate an existing disk array:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. From the dropdown menu the Background Activities tab, select *Start Migration*.
5. Highlight physical drives you want in the disk array from the Available list and press the >> button to move them to the Selected list.

   You can also double-click them to move them.
6. When you are done, click the **Next** button.
7. Select a new RAID Level, if desired.
8. To expand the disk array's capacity, check the Expand Capacity box.
9. If you checked the Expand Capacity box, enter a number into the Capacity field and select the appropriate unit of measure (MB, GB, TB).

- Under Capacity Usage, highlight the logical drive whose RAID level you want to change or whose capacity you want to expand.

11. Click the **Update** button.

    The logical drive changes to reflect your choices.
12. Update other logical drives using the same method.
13. When you are done making the changes, click the **Next** button.
14. Click the **Submit** button to begin Migration.

To set Migration priority, see Making B.

Rebuilding a Disk Array

When you rebuild a disk array, you are actually rebuilding the data on a replacement physical drive.

Rebuilding Automatically

Normally, a disk array would rebuild itself using a hot disk drive, after going Critical. However, if the Auto Rebuild function is disabled or no spare drives are available, you must initiate the procedure.

To enable Auto Rebuild, see Making B.

To create a spare drive, see Creating a S.

For more information, see “Hot Spare Drive(s)”.

Rebuilding Manually

If a physical drive has failed, identify and replace the drive, then rebuild the disk array as described below:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.

   If there are multiple disk arrays, choose the icon with the yellow !.
4. From the dropdown menu the Background Activity tab, select *Start Rebuild*.
5. Select the Source physical drive.

   This is a remaining functional physical drive in the disk array.
6. Select the Target physical drive.

   This is the replacement physical drive.
7. Click the **`Submit`** button.

The Disk Array Background Activity tab shows the rebuild progress on the replacement (target) physical drive. Depending the size of the physical disk involved, this process will take some time.

To view more information, click the **`Rebuild on PDx`** link.

To set Rebuild priority, see Making B.

Running Media Patrol on a Disk Array

Media Patrol checks the magnetic media on physical drives. When it finds the specified number of bad blocks, it will trigger PDM. See Making B and Running P.

You can schedule Media Patrol to run automatically, see Scheduling an A.

To start Media Patrol:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. From the dropdown menu the Background Activities tab, choose Start Media Patrol.
5. Click the **`Start`** button.

Running PDM on a Disk Array

Predictive Data Migration (PDM) migrates data from the suspect physical drive to a spare physical drive, similar to Rebuilding. But unlike Rebuilding, PDM acts before the disk drive fails and your Logical Drive goes Critical.

See “Predictive Data Migration (PDM)” in chapter 7.

To start PDM:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Background Activities tab in Management View.
5. From the dropdown menu the Background Activities tab, choose Start PDM.

6. In the next screen, select the Source and Target physical drives.

   The suspect physical drive is the source. The replacement physical drive is the target.
7. Click the **Start** button.

Transitioning a Disk Array

Transition is the process of replacing a revertible spare drive that is currently part of a disk array with an unconfigured physical drive or a non-revertible spare. The revertible spare drive returns to its original status. For more information, see “Transition” in chapter 7.

In order to run the Transition function:

- The spare drive must be Revertible.
- You must specify an unconfigured physical drive of the same or larger capacity to replace the revertible spare drive.

To run Transition:

1. Click the Subsystem icon in Tree View.
2. From the dropdown menu on the Background Activities tab, select *Start Transition*.
3. Select an unconfigured physical drive from the list of available drives.
4. From the Target Physical Drive dropdown menu, choose an unconfigured physical drive.
5. Click the **Submit** button.

After Transition is completed, refresh the screen. The revertible spare drive will be listed under the Spare Drives icon and the disk array’s operational status will show OK.

To set Transition priority, see Making B.

Preparing a Disk Array for Transport

Transport is the action of moving the physical drives of a disk array:

- To different slots in the same Galaxy3G enclosure
- From one Galaxy3G enclosure to another

Important

Before you can use this feature:

- There must be a dedicated spare disk drive assigned to this disk array.
- The disk array’s Operational Status must be OK.

-

To prepare a disk array for transport:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Transport tab in Management View.
5. Click the **Submit** button.
6. In the confirmation box, type the word **confirm** in the field provided.
7. Click the **OK** button.
8. After the Transition is complete, move the physical drives comprising the disk array to their new locations.

9. Click the **Refresh** button in your Browser.
   The drives appear in their new locations and disk array status displays OK.

4.24 Managing Logical Drives

Logical drives are made from disk arrays. In the Tree, you can see a graphic representation of the logical drives that belong to each array. You can see a summary of all logical drives in the subsystem under Logical Drive Summary.

Logical drive management includes the following functions:

- Viewing Information for All Logical Drives
- Viewing Logical Drive Information
- Viewing Logical Drive Statistics
- Making Logical Drive Settings
- Initializing a Logical Drive
- Running Redundancy Check
- Viewing the Logical Drive Check Table
- Making Logical Drive LUN Settings

Viewing Information for All Logical Drives

To view information about all logical drives in a disk array:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Logical Drives icon

Logical Drive Status

- OK – This is the normal state of a logical drive. When a logical drive is Functional, it is ready for immediate use. For RAID Levels other than RAID 0 (Striping), the logical drive has full redundancy.
- Synchronizing – This condition is temporary. Synchronizing is a maintenance function that verifies the integrity of data and redundancy in the logical drive. When a logical drive is Synchronizing, it will function and your data is available. However, access will be slower due to the synchronizing operation.
- Rebuilding – This condition is temporary. When a physical drive has been replaced, the logical drive automatically begins rebuilding in order to restore redundancy (fault tolerance). When a logical drive is rebuilding, it will function and your data is available. However, access will be slower due to the rebuilding operation.
- Critical – This condition arises as the result of a physical drive failure. A degraded logical drive will still function and your data is still available. However, the logical drive has lost redundancy (fault tolerance). You must determine the cause of the problem and correct it.
- Offline – This condition arises as the result of a second physical drive failure. An Offline logical drive is not accessible but some or all of your data may remain intact. You must determine the cause of the problem and correct it.
- Transport Ready – After you perform a successful Prepare for Transport operation, this condition means you can remove the physical drives of this disk array and move them to another enclosure or different drive slots. After you relocate the physical drives, the disk array status will show OK.

To create a logical drive, see Creating a L.

To delete a logical drive, see Deleting a L.

For a Degraded or Offline logical drive, see “Critical & Offline Disk Arrays” in chapter 7.

Viewing Logical Drive Information

To view information for a single logical drive:

1. Click the Subsystem icon in Tree View.

2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Logical Drives icon
5. Click the Logical Drive icon.

To specify an Alias or set the Read and Write Policies, click the Settings tab.

Logical Drive Status

See Logical D.

Logical Drive Synchronization

Synchronization is an automatic procedure applied to logical drives when they are created. Yes means the logical drive was synchronized.

Adjustable Items

- Alias – Optional.
- Read Policy
- Write Policy
- Preferred Controller ID

See Logical Drive S.

Viewing Logical Drive Statistics

To view information for a single logical drive:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Logical Drives icon
5. Click the Logical Drive icon.
6. In Management View, click on the dropdown menu on the Information tab and choose Statistics.

Clearing Statistics

To clear statistics, see

4.17 Clearing S.

Making Logical Drive Settings

To make Logical Drive settings:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Logical Drives icon
5. Click the Logical Drive icon.
6. Click the Settings tab in Management View.
7. Optional. Enter an alias in the Logical Drive Alias field.

   Maximum of 32 characters. Use letters, numbers, space between words, and underscore. An alias is optional.
8. From the Read Policy dropdown menu, select a Read Cache policy.

   The choices are Read Cache, Read Ahead, and No Cache.
9. From the Write Policy dropdown menu, select a Write Cache policy.

   The choices are Write Back and Write Through (Thru). If you select No Read Cache, Write policy is automatically Write Through.

- From the Preferred Controller ID dropdown menu, select the preferred controller to access this logical drive.

  The choices are 1 and 2. This feature is only available on subsystems with two controllers and LUN Affinity enabled. If N/A is shown, there is only one controller in the enclosure.

11. Click the **`Submit`** button.

Initializing a Logical Drive

Initialization is done to logical drives after they are created from a disk array. Initialization sets all data bits in the logical drive to zero. The action is useful because there may be residual data the logical drives left behind from earlier configurations. For this reason, Initialization is recommended for all new logical drives.

Caution

When you initialize a logical drive, all the data in the logical drive will be lost. Backup any important data before you initialize a logical drive.

Initialize a Logical Drive:

1. Click the Subsystem icon in Tree View.
2. Click the Logical Drive Summary icon.
3. Click the icon of the logical drive you want to Initialize.

   You can also start Initialization from the Subsystem icon Background Activities tab
4. Click the Background Activities tab in Management View.
5. From the Background Activities dropdown menu, select *Initialization*.
6. To select Quick Initialization, check the box.

   If you checked the box, enter a value in the Quick Initialization Size field. This value is the size of the initialization blocks in MB.

7. If you did not select Quick Initialization, enter a hexadecimal value in the Initialization Pattern in Hex field or use the default 00000000 value.
8. Click the **Submit** button.
9. In the confirmation box, type the word **confirm** in the field provided.

- Click the **OK** button.

To view the progress of the Initialization, click the Background Activity tab.

To set Initialization priority, see Making B

Running Redundancy Check

Redundancy Check is a routine maintenance procedure for fault-tolerant logical drives (those with redundancy) that ensures all the data matches exactly. Redundancy Check can also correct inconsistencies. You can also schedule a Redundancy Check. See Scheduling an A.

Redundancy Check a Logical Drive:

1. Click the Subsystem icon in Tree View.
2. Click the Logical Drive Summary icon.
3. Click the icon of the logical drive you want to Initialize.

   You can also start Redundancy check from the Subsystem icon Background Activities tab
4. From the dropdown menu on the Background Activities tab, select *Redundancy Check*.
5. To select Auto Fix, check the box.

   This feature attempts to repair the problem when it finds an error.
6. To select Pause On Error, check the box.

   This feature stops the process when it finds an error.

   If Auto Fix is also checked, the process stops only when it finds a non-repairable error.
7. Click the **Submit** button.

To view the progress of the Redundancy Check, click the Background Activity tab.

To set Redundancy Check priority, see Making B.

Viewing the Logical Drive Check Table

The Logical Drive Check Table displays errors related to a logical drive. Use this information to evaluate the integrity of the logical drive and to determine whether corrective action is needed. To View the tables:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Logical Drives icon
5. Click the Logical Drive icon.
6. Click the Check Table tab in Management View.
7. Click the option for the table you want to see.

   The default is All tables.

   If there are entries, they are listed as follows:
   - Entry Number – A number assigned to each block of entry.
   - Table Type – Read Check, Write Check or Inconsistent Block (see below).
   - Start Logical Block Address – LBA of the first block for this entry.
   - Count – Number of continuous blocks starting from this LBA.

Table Definitions

- Read Check Table – Contains a list of read errors for this logical drive.
- Write Check Table – Contains a list of write errors for this logical drive.
- Inconsistent Block Table – Contains a list of inconsistent blocks for this logical drive. Mirror data for RAID Levels 1, 1E, and 10 or Parity data for RAID Levels 5, 6, 50, and 60 identified by the Redundancy Check (a background function).

Making Logical Drive LUN Settings

For Fibre Channel and SAS, LUN Masking is the process of applying a LUN Map so that each initiator can only access the LUNs specified for it.

Before you can specify an initiator for your LUN map, you must add the initiator to the Galaxy3G 's initiator list. See

Adding an I

You must enable LUN Masking in order apply a LUN map. See Enabling L.

To specify a LUN Map:

1. Click the Subsystem icon in Tree View.
2. Click the Disk Arrays icon.
3. Click the Disk Array icon.
4. Click the Logical Drives icon
5. Click the Logical Drive icon.
6. Click the LUN Map tab in Management View.
7. From the Unassigned Initiator List, click on an initiator to select it.
   Or type the initiator name into the Initiator Name field.
8. Type a LUN into the Map to LUN field.
9. Click the **Assign** button.
   The initiator appears in the Assigned Initiator List.

- Click the **Submit** button.

Notes

- Obtain the initiator name from the initiator utility on your host system.
- The initiator name you input must match exactly in order for the connection to work.

LUN Mapping Parameters

- Initiator Name
  - Fibre Channel – A Fibre Channel initiator name is the World Wide Port Name of the device and is composed of a series of eight, two-digit hexadecimal numbers.
  - SAS – A SAS initiator name is the SAS address of the HBA card in the Host PC.
- Alias – Optional. A common name for an iSCSI initiator
- Symbolic Name – Optional. A common name for a Fibre Channel initiator
- Port ID – Port ID of the Fibre Channel port for this initiator

- LUN – Logical Unit Number on this logical drive for the selected initiator. You must enter different LUN numbers for each logical drive.

4.25 Managing Spare Drives

When a physical drive in a disk array fails and a spare drive of adequate capacity is available, the disk array will begin to rebuild automatically using the spare drive. See “Critical & Offline Disk Arrays” in chapter 7.

Spare drive management includes the following functions:

- Viewing a List of Spare Drives
- Locating a Spare Drive
- Creating a Spare Drive
- Deleting Spare Drive
- Making Spare Drive Settings
- Running Spare Check

Viewing a List of Spare Drives

To view a list of spare drives:

1. Click the Subsystem icon in Tree View.
2. Click the Spare Drives icon.

The information includes:

- ID – The unique ID number assigned to the spare drive.
- Operational Status – OK is normal. Can also show Rebuilding, Transition Running, PDM Running, or Offline.
- Physical Drive ID – The ID number of the physical drive in the subsystem enclosure.
- Capacity – The data storage capacity of this spare drive.
- Revertible – Yes or No. A revertible spare drive automatically returns to its spare drive assignment after the failed physical drive in the disk array is replaced.
- Type –Global, can be used by any disk array. Dedicated, can only be used by the assigned disk array.
- Dedicated to Array – For dedicated spares, the disk array to which it is assigned. Global spares show N/A.

Locating a Spare Drive

To locate a physical drive assigned as a spare drive in the Galaxy3G subsystem enclosure:

1. Click the Subsystem icon in Tree View.
2. Click the Spare Drives icon.
3. Click the Spare Drive icon.

   In Management View, the Enclosure Front View diagram appears with the location of the spare drive highlighted.

Creating a Spare Drive

Important

- There must be an unconfigured physical drive available for selection as a spare drive. See Viewing a List of Physical Drives
- Identifying a Physical Drive
- Making Global Physical Drive Settings
- Viewing Physical Drive Information

- Viewing Physical Drive Statistics
- Making Physical Drive Settings
- Clearing Stale and PFA Conditions
- Forcing a Physical Drive Offline or Online

- Viewing a List of P.
- Be sure the unconfigured physical drive has adequate capacity to replace the largest drive in the disk array.

To create a spare drive:

1. Click the Subsystem icon in Tree View.
2. Click the Spare Drives icon.
3. Click the Create tab in Management View.
4. Select a spare type, Global or Dedicated.

   Global can be used by any disk array. Dedicated can only be used by the assigned disk arrays
5. To make a revertible spare drive, check the Revertible box.

   A revertible spare drive can be returned to spare drive status after it replaces a failed drive in a disk array. See “Transition” in chapter 7 for more information.
6. In the Physical drives field, highlight the physical drive you want to assign as a spare drive in the Available list and press the **>>** button to move the drive to the Selected list.

   You can also double-click drives to move them.
7. If you selected a Dedicated spare drive, in the Dedicated to Disk Arrays field, highlight disk arrays to which you want assign the spare drive from the Available list and press the **>>** button to move the array to the Selected list.

   You can also double-click arrays to move them.
8. Click the **`Update`** button.

   Your choices are displayed under New Hot Spare Drives.
9. If you agree with the proposed choices, click the **`Submit`** button.

Deleting a Spare Drive

Note

If an existing spare drive has the wrong parameters for your needs, click the Settings tab to change the parameters rather than delete the spare drive and create a new one.

To delete a spare drive:

1. Click the Subsystem icon in Tree View.
2. Click the Spare Drives icon.
3. Click the Delete tab in Management View.
4. Check the box to the left of the spare drive you want to delete.
5. Click the **`Submit`** button.

In the confirmation box, type the word **confirm** in the field provided.

6. Click the **OK** button.

Making Spare Drive Settings

The Spare Drive–Settings tab enables you to change the settings of an existing spare drive. To change spare drive settings:

1. Click the Subsystem icon in Tree View.
2. Click the Spare Drives icon.
3. Click the Spare Drive icon.
4. Click the Settings tab in Management View.
5. Select a spare type, Global or Dedicated.

   Global can be used by any disk array. Dedicated can only be used by the assigned disk arrays
6. To make a revertible spare drive, check the Revertible box.

   A revertible spare drive automatically returns to its spare drive assignment after the failed physical drive in the disk array is replaced.
7. If you selected a Dedicated spare drive, in the Dedicated to Disk Arrays field, highlight the disk arrays to which you want assign the spare drive from the Available list and press the **>>** button to move them to the Selected list.

   You can also double-click array to move it.
8. Click the **Submit** button.

Running Spare Check

Spare Check verifies the operational status of your spare drives. You can also schedule a Spare Check. See Scheduling an A.

To check a spare drive:

1. Click the Subsystem icon in Tree View.
2. Click the Spare Drives icon.
3. Click the Spare Check tab in Management View.
4. From the Physical Drive dropdown menu, select the spare drive you want to check.

   Or select All to check all the spare drives at the same time.
5. Click the **Submit** button.

The results of the Spare Check appear under Spare Check Status in the Information tab. “Healthy” means normal condition.

4.26 Working with the Logical Drive Summary

The Logical Drive Summary displays a list of all logical drives in the Galaxy3G enclosure plus the expanded or cascaded enclosures. This list does not arrange the logical drives under the disk array to which they belong nor under the enclosure in which they are located.

Logical Drive Summary includes the following functions:

- Viewing a List of All Logical Drives
- Viewing Individual Logical Drive Information

Viewing a List of All Logical Drives

To view a list of all logical drives in all enclosures:

1. Click the Subsystem icon in Tree View.
2. Click the Drive Summary icon.

Viewing Individual Logical Drive Information

1. Click the Subsystem icon in Tree View.
2. Click the Drive Summary icon.
3. Click the Logical Drive icon.

   The information and location for the logical drive appear in Management View. See Viewing Logical Drive Information.

Section 5
Management with CLU

5.0 Management with CLU

This chapter covers the following topics:

- 5.1 Logging into the CLU
- 5.2 Running Quick Setup
- 5.3 Managing the Subsystem
- 5.4 Managing the Controllers
- 5.5 Managing the Enclosure
- 5.6 Managing Physical Drives
- 5.7 Managing Disk Arrays
- 5.8 Managing Logical Drives
- 5.9 Managing the Network Connection
- 5.10 Managing Fibre Channel Connections
- 5.11 Managing SAS Connections
- 5.12 Managing Background Activity
- 5.13 Working with the Event Viewer
- 5.14 Managing Spare Drives
- 5.15 Working with LUN Mapping
- 5.16 Managing Users
- 5.17 Working with Software Management
- 5.18 Flashing through TFTP
- 5.19 Clearing Subsystem
- 5.20 Restoring Factory Defaults
- 5.21 Shutting Down the Subsystem
- 5.22 Restarting the Subsystem
- 5.23 Configuring Buzzer Settings

5.1 Logging into the CLU

There are two connections methods for the CLU:

- **`Serial`** – Requires a null-modem cable to connect the serial ports on the Host PC and Galaxy3G
- **`Telnet`** – Requires a network connection between the Host PC and Galaxy3G's Management Port

Making a Serial Connection

Before you begin, be sure the null modem cable is connected between the Host PC and Galaxy3G, and that both machines are booted and running. Then do the following actions:

Start your PC's terminal emulation program.

- Press **`Enter`** once to launch the CLU.

Making a Telnet Connection

If your Telnet connection has not been setup, refer to "Making Serial Cable Connections" on page 26.

To start the telnet program:

1. Go to the command line prompt (Windows) or click the terminal icon (Linux), then run:

   `a. telnet 192.168.1.129 2300`

   - The IP address above is only an example. Use your Galaxy3G's Management port IP address. `2300` is the Telnet port for the Galaxy3G.

2. The telnet login screen appears:
3. At the Login prompt, type the user name and press Enter.

- The default user name is `administrator`.
- At the Password prompt, type the password and press Enter.
- The default password is `password`.

4. The CLI screen appears.
1. At the CLI prompt, type **menu** and press Enter

   The CLU Main Menu appears.

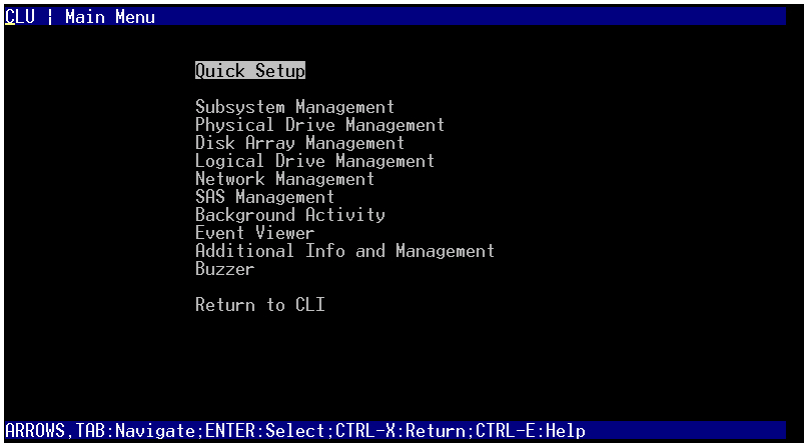


Fig 5.1a Galaxy 3G CLU Main Menu

`Quick Setup` – A sequence of four steps to setup System Date & Time, Management Port, and RAID Configuration.

`Subsystem Management` – View controller information, lock/unlock the controller, set date and time, and monitor the enclosure.

`Physical Drive Management` – View disk drive assignments and parameters, change disk drive cache settings and command queuing, and locate a physical drive.

`Disk Array Management` – View disk array information, create and delete disk arrays, transport, rebuild, PDM, and transition functions, and locate a disk array, create and delete logical drives.

`Logical Drive Management` – View logical drive information, name logical drives, initialization and redundancy check, and locate a logical drive.

`Network Management` – Set IP addresses for Management Port, gateway, and DNS server; subnet mask.

`Fibre Channel Management` – Node information, Port information, settings and statistics, list of logged-in devices, list of initiators.

`SAS Management` – Node information, Port information, settings, status, and statistics; SFP information, list initiators.

`Background Activity` – Settings for Media Patrol, Auto Rebuild, Rebuild, Migration, PDM, Transition, Synchronization, Initialization, Redundancy Check rate, and thresholds.

`Event Viewer` – View the event logs.

`Additional Info and Management` – Spare Drives, LUN Mapping, User management, EMail, SLP, Webserver, Telnet, SNMP, CIM, and Netsend settings, firmware flash, clear statistics and restore factory default settings.

`Buzzer` – Enable, disable or silence the buzzer (audible alarm).

Accessing Online Help

To access online help on any CLU screen, press Ctrl-E.

To return to the CLU, press Enter.

Logging out of the CLU

1. Highlight Return to Previous Menu and press Enter.
   - Repeat this action until you arrive at the Main Menu.
2. From the Main Menu, highlight Return to CLI and press **Enter** to exit
3. Close the terminal emulation, Telnet or terminal window.

5.2 Running Quick Setup

Quick Setup is discussed under “Setting up the Serial Connection” in chapter 2.

5.3 Managing the Subsystem

Subsystem Management includes the following functions:

- Setting an Alias for the Subsystem
- Setting Redundancy for the Subsystem
- Setting the Cache Mirroring for the Subsystem
- Running Media Patrol
- Locking or Unlocking the Subsystem
- Setting Subsystem Date and Time

Setting an Alias for the Subsystem

An alias is optional. To set an Alias for this subsystem:

1. From the Main Menu, highlight Subsystem Management and press Enter.
    - Type an alias name into the Alias field.
      Maximum of 48 characters. Use letters, numbers, space between words and underscore.
2. Press Ctrl-A to save your settings.

Setting Redundancy for the Subsystem

This feature applies to Fibre Channel models with dual controllers.

To set redundancy:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Redundancy Type and press the spacebar to toggle between Active-Active and Active-Standby.
    - Active-Active – Both RAID controllers are active and can share the load
    - Active-Standby – One RAID controller is in standby mode and goes active if the other fails
3. Press Ctrl-A to save your settings.

This option applies only to subsystems with two controllers. To use Cache Mirroring, the Redundancy Type must be set to Active-Active.

Setting Cache Mirroring for the Subsystem

To change Cache Mirroring for this subsystem:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Redundancy Type and press the spacebar to toggle between Active-Active and Active-Standby.
3. Highlight Cache Mirroring and press the spacebar to toggle between Enabled and Disabled.
4. Press Ctrl-A to save your settings.
5. Restart the subsystem.

See "Restarting the Subsystem"

Notes

- If you disable Cache Mirroring, LUN Affinity will be enabled automatically.
- If you change Cache Mirroring, be sure both controllers are properly installed in the subsystem before you restart.

Running Media Patrol

Media Patrol is a routine maintenance procedure that checks the magnetic media on each disk drive. Media Patrol checks all physical drives assigned to disk arrays and spare drives. It does not check unconfigured drives.

To start, stop, pause or resume Media Patrol:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Media Patrol and press enter.
3. Highlight Start, Stop, Pause, or Resume and press Enter.
4. If you chose Stop, press Y to confirm.

Locking or Unlocking the Subsystem

The lock prevents other sessions (including by the same user) from making a configuration change to the controller until the lock expires or a forced unlock is done. When the user who locked the controller logs out, the lock is automatically released.

Setting the Lock

To set the lock:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Lock Management and press Enter. In the Lock Time field, type a lock time in minutes. 1440 minutes = 24 hours
3. Highlight Lock and press Enter.

Resetting the Lock

To reset the lock with a new time:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Lock Management and press Enter. In the Lock Time field, type a lock time in minutes. 1 to 1440 minutes (24 hours)
3. Highlight Renew and press Enter.

Releasing the Lock

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Lock Management and press Enter.
3. Highlight Unlock and press Enter.

Releasing a Lock set by another user

To release somebody else's lock:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Lock Management and press Enter.
3. Highlight Force Unlock and press the Spacebar to change to Yes.
4. Highlight Unlock and press Enter.

Setting Subsystem Date and Time

Use this screen to make Date and Time settings:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Modify System Date and Time and press Enter.
3. Highlight the System Date or System Time setting. Press the backspace key to erase the current value.

4. Type in a new value.
5. Press Ctrl-A to save your settings.

5.4 Managing the Controllers

Controller Management includes the following functions:

- Viewing Controller Information
- Clearing an Orphan Watermark
- Making Controller Settings
- Locating the Controller

Viewing Controller Information

Controller Management includes information, settings and statistics.

To access Controller Management:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Controller Management and press Enter.
3. Highlight the controller you want and press Enter.

   Basic Controller information displays.

To access additional controller information, highlight Advanced Information and press Enter.

To access controller statistics, highlight Controller Statistics and press Enter.

Clearing an Orphan Watermark

This condition is the result of a disk drive failure during an NVRAM RAID level migration on a disk array.

To clear an orphan watermark:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Controller Management and press Enter.
3. Highlight one of the controllers and press Enter.
4. Highlight Clear Orphan Watermark and press Enter.

The condition is cleared. See “Physical Drive Failed” in chapter 7 for more information.

Making Controller Settings

An alias is optional. To set an Alias for this controller:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Controller Management and press Enter.
3. Highlight the controller you want and press Enter.
4. Highlight Controller Settings and press Enter.
5. Make the following settings as required:
   - Type an alias name into the Alias field. Maximum of 48 characters. Use letters, numbers, space between words and underscore. An alias is optional.
   - Highlight LUN Affinity and press the spacebar to toggle between Enabled and Disabled.
   - Highlight Coercion and press the spacebar to toggle between Enable and Disable.
   - Highlight Coercion Method and press the spacebar to toggle through:

     GB Truncate – Reduces the capacity to the nearest 1 GB boundary

     10 GB Truncate – Reduces the capacity to the nearest 10 GB boundary

     Grp (group) Rounding – Uses an algorithm to determine truncation. Results in the maximum amount of usable drive capacity

     Table Rounding – Applies a predefined table to determine truncation
   - Highlight Cache Flush Interval and press the backspace key to erase the current value. Type a new interval value (1 to 12 seconds).
   - Highlight SMART and press the spacebar to toggle between Enable and Disable.

- Highlight SMART Poll Interval and press the backspace key to erase the current value. Type a new interval value (1 to 1440 minutes).
- Highlight Adaptive Writeback Cache and press the spacebar to toggle between Enabled and Disabled.

6. Press Ctrl-A to save your settings.

Locating the Controller

To locate this controller:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Controller Management and press Enter.
3. Highlight the controller you want and press Enter.
4. Highlight Controller Settings and press Enter.
5. Highlight Locate Controller and press Enter.

Controller Dirty Cache LED and Status LED, on the back of the Controller, will flash for one minute.

5.5 Managing the Enclosure

Enclosure Management includes the following functions:

- Viewing Voltage Sensor Status
- Viewing Temperature Sensor Status
- Setting Temperature Thresholds
- Checking the Batteries
- Viewing Enclosure Topology
- Locating an Enclosure
- Reconditioning a Battery

- Viewing Enclosure Information
- Viewing Power Supply Status
- Locating a Power Supply
- Viewing Blower Status
- Viewing Voltage Sensor Status
- Viewing Temperature Sensor Status
- Setting Temperature Thresholds
- Checking the Batteries
- Viewing Enclosure Topology
- Locating an Enclosure
- Reconditioning a Battery

Viewing Enclosure Information

Enclosure Management includes information, status, settings and location. To access Enclosure Management:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.

To access FPU VPD information (vital product data on field replaceable units), highlight FPU VPD Information and press Enter.

To access the current status of the power supplies, blowers, temperature or voltage sensors, highlight the item you want and press Enter.

Viewing Power Supply Status

To view the status of the power supplies:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.
3. Highlight Power Supplies and press Enter.

The screen displays the operational and fan status of Galaxy3G's two power supplies. If any status differs from normal or the fan speed is below the Healthy Threshold value, there is a fan/power supply malfunction. See "Replacing a Power Supply" in chapter 7.

Locating a Power Supply

To locate a power supply:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.
3. Highlight Power Supplies and press Enter.

4. Highlight Locate Power Supply and press Enter.

The LED on the selected power supply blinks for one minute.

Viewing Blower Status

To view the status of the blowers:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.
3. Highlight Blowers and press Enter.

The screen displays the status and speed of Galaxy3G's blowers. There is one blower in each cooling unit. If blower speed is below the Healthy Threshold, there is a blower malfunction. See "Replacing a Cooling Unit Blower" in chapter 7..

Viewing Voltage Sensor Status

To view the status of the voltage sensors:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.
3. Highlight Voltage Sensors and press Enter.

If any voltage is outside the Healthy Threshold values, there is a voltage malfunction in the enclosure. See "Chapter 8: Troubleshooting"

Viewing Temperature Sensor Status

To view the status of the temperature sensors:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.
3. Highlight Temperature Sensors and press Enter.

If any temperature exceeds the Healthy Threshold value, there is an overheat condition in the enclosure. See Setting Temperature T and "Chapter 8: Troubleshooting"

Setting Temperature Thresholds

To change temperature thresholds:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.
3. Highlight Enclosure Settings and press Enter.
4. Highlight the Temperature Warning threshold you want to change.
5. Press the backspace key to erase the current value.
6. Type a new interval value in degrees C.
7. Press Ctrl-A to save your settings.

Checking the Batteries

This feature enables you monitor and recondition the subsystem battery or batteries.

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.
3. Highlight Batteries and press Enter.
4. Highlight the battery you want to monitor and press Enter.

Battery Notes

Each battery works with a controller. If the battery is present in the subsystem but the corresponding controller is not present, the battery will not appear in the interface.

If a battery does not reflect normal conditions and it is not currently under reconditioning, run the Recondition function before you replace the battery. See Reconditioning a Battery below.

If a battery reaches the threshold temperature while charging or discharging, the charge or discharge pauses and the blower runs at high speed until the battery temperature falls below the threshold.

If the battery does not maintain normal values after a Recondition, replace the battery. See “Replacing a Cache Battery” in chapter 7..

Galaxy3G automatically reconditions the battery every two months.

When you install a new battery, the cycle count shows 0. Galaxy3G automatically runs a recondition on the battery to verify it. If you restart the subsystem or controller before reconditioning is finished, the battery is charged to 100%, then reconditioning starts again.

Reconditioning a Battery

To recondition the subsystem battery:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.
3. Highlight Batteries and press Enter.
4. Highlight the battery you want to monitor and press Enter.
5. Highlight Recondition Battery and press Enter.
6. Press Y to confirm.

During reconditioning, Battery status can show “discharging” and “recharging”, and a value will display next to Current. During that time, the controller cache is reset to Write Thru. Reconditioning runs in the background and stops automatically upon completion.

Galaxy3G automatically reconditions the battery every two months.

Locating an Enclosure

This feature helps you identify the physical Galaxy3G enclosure you are working with through the CLU.

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Management and press Enter.
3. Highlight Locate Enclosure and press Enter.

The LEDs on the front of the Galaxy3G will blink for one minute.

Viewing Enclosure Topology

This feature displays the connection topology of the Galaxy3G subsystem. Topology refers to the manner in which the data paths among the enclosures are connected. There are three methods:

- Individual Subsystem
- JBOD Expansion – Managed through one subsystem or head unit
- RAID Subsystem Cascading – Managed through one subsystem or head unit

For more information, see “Making Management and Data Connections” in chapter 2.

To view enclosure topology:

1. From the Main Menu, highlight Subsystem Management and press Enter.
2. Highlight Enclosure Topology and press Enter.

5.6 Managing Physical Drives

Physical Drive Management includes the following functions:

- Making Global Physical Drive Settings
- Setting an Alias
- Viewing Advanced Information
- Viewing Physical Drive Statistics
- Clearing Stale and PFA Conditions
- Forcing a Physical Drive Offline or Online
- Locating a Physical Drive

Making Global Physical Drive Settings

All physical drive settings are made globally, except for setting an alias, which applies to individual drives.

To make global physical drive settings:

1. From the Main Menu, highlight Physical Drive Management and press Enter.
2. Highlight Global Physical Drives Settings and press Enter.
3. Change the following settings as required.

   For SATA drives:

   - Highlight Write Cache and press the spacebar to toggle between Enabled and Disabled.
   - Highlight Read Look Ahead Cache and press the spacebar to toggle between Enabled and Disabled.
   - Highlight CmdQueuing and press the spacebar to toggle between Enabled and Disabled.
   - Highlight DMA Mode and press the spacebar to toggle through UDMA 0–5 and MDMA 0–2.

   For SAS drives:

   - Highlight Write Cache and press the spacebar to toggle between Enabled and Disabled.
   - Highlight Read Look Ahead Cache and press the spacebar to toggle between Enabled and Disabled.
   - Highlight CmdQueuing and press the spacebar to toggle between Enabled and Disabled.
   - Highlight Read Cache and press the spacebar to toggle between Enabled and Disabled.
4. Press Ctrl-A to save your settings.

Setting an Alias

An alias is optional. To set an Alias for a physical drive:

1. From the Main Menu, highlight Physical Drive Management and press Enter.
2. Highlight the physical drive of your choice and press Enter.
3. Type an alias into the Alias field.
4. Maximum of 32 characters. Use letters, numbers, space between words and underscore.
5. Press Ctrl-A to save your settings.

Viewing Advanced Information

To view advanced information about the selected physical drive:

1. From the Main Menu, highlight Physical Drive Management and press Enter.
2. Highlight the physical drive of your choice and press Enter.
3. Highlight Advanced Information and press Enter.

Viewing Physical Drive Statistics

To view the statistics for the selected physical drive:

1. From the Main Menu, highlight Physical Drive Management and press Enter.
2. Highlight the physical drive of your choice and press Enter.
3. Highlight Physical Drive Statistics and press Enter.

Clearing Stale and PFA Conditions

The Clear Stale and Clear PFA functions only appear when those conditions exist on the physical drive. To clear a Stale or PFA condition on a physical drive:

1. From the Main Menu, highlight Physical Drive Management and press Enter.
2. Highlight the physical drive of your choice and press Enter.
3. Highlight Clear Stale or Clear PFA and press Enter.

If a physical drive is still online and shows a PFA error but “Clear PFA” does not appear, use PDM to copy the data to a new physical drive. Go to Disk Array Info and Settings.

If a physical drive is offline and shows a PFA error, rebuild the disk array. Go to Disk Array Info and Settings. After rebuilding, the drive will show Stale. Run Clear Stale then run Clear PFA.

If the physical drive with a PFA error is a spare, you must delete the drive as a spare, then Clear PFA will be available.

After you clear a PFA error, watch for another PFA error to appear. If it does, replace the physical drive.

Forcing a Physical Drive Offline or Online

This function enables you to force an:

- Online physical drive to go Offline
- Offline physical drive to go Online

The Force Offline/Online function appears only for physical drives that are assigned to disk arrays.

Caution

Forcing a physical drive offline or online is likely to cause data loss. Back up your data before you proceed. Use these functions only when required.

To force a physical drive offline or online:

1. From the Main Menu, highlight Physical Drive Management and press Enter.
2. Highlight Global Physical Drives Settings and press Enter.
3. Highlight the physical drive of your choice and press Enter.
4. Highlight Force Offline or Force Online and press Enter.
5. Press Y to confirm.

Locating a Physical Drive

This feature helps you identify a physical drive within the Galaxy3G enclosure you are working with through the CLU. To locate a physical drive:

1. From the Main Menu, highlight Physical Drive Management and press Enter.
2. Highlight Global Physical Drives Settings and press Enter.
3. Highlight the physical drive of your choice and press Enter.
4. Highlight Locate Physical Drive and press Enter.

   The drive carrier LEDs on the front of the Galaxy3G will blink for one minute.

5.7 Managing Disk Arrays

Disk Array Management includes the following functions:

- Creating a Disk Array
- Creating a Disk Array – Automatic
- Creating a Disk Array – Express
- Creating a Disk Array – Advanced
- Deleting a Disk Array
- Viewing Disk Array Information
- Setting an Alias for a Disk Array
- Accepting an Incomplete Array
- Enabling Media Patrol on a Disk Array
- Enabling PDM on a Disk Array
- Preparing the Disk Array for Transport
- Rebuilding a Disk Array
- Migrating a Disk Array
- Running PDM
- Running Transition on a Disk Array
- Locating a Disk Array
- Creating a Logical Drive
- Deleting a Logical Drive

Creating a Disk Array

The CLU provides three methods of creating a disk array:

- **Automatic** – Creates a default disk array and logical drive based on unconfigured physical drives in the system. No user choices. See Creating a Disk Array – Automatic below.
- **Express** – You select the RAID characteristics and type of application. Creates a disk array and logical drive(s) based on your input. See Creating a disk array- Express below.
- **Advanced** – You specify all parameters for a new disk array. One logical drive will be made automatically when you create the disk array. If you select less than the total available capacity, you can use the remaining space to create additional logical drives at a later time. See Creating a Disk Array-Advanced below.

Creating a Disk Array – Automatic

To create a disk array using the Automatic feature:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight Create New Array and press Enter.
3. Highlight Configuration Method and press the spacebar to toggle to Automatic.
4. Review the proposed configuration of disk array and logical drive(s).
   - To accept the proposed configuration and create the disk array and logical drive(s), highlight Save Configuration and press Enter.
   - To reject the proposed configuration, highlight Cancel Array Configuration and press Enter. You will return to the Disk Arrays Summary screen.

   To create a disk array with different characteristics, repeat the steps above specifying different parameters but choose the Express or Advanced option.

Creating a Disk Array – Express

To create a disk array using the Express feature:

1. From the Main Menu, highlight Disk Array Management and press Enter.

2. Highlight Create New Array and press Enter.
3. Highlight Configuration Method and press the spacebar to toggle to Express.
4. Highlight Configuration Method and press to spacebar to select each of the following characteristics for your disk array:
   - Redundancy
   - Capacity
   - Performance
   - Spare Drive
5. Highlight Number of Logical Drives and press the backspace key to erase the current value.
6. Enter the number of logical drives you want.
7. Highlight Application Type and press the spacebar to toggle though the applications and select the best one for your disk array.
   - File Server
   - Video Stream
   - Transaction Data
   - Transaction Log
   - Other
8. Press Ctrl-A to save your settings and move to the next screen.
9. Review the proposed configuration of disk array and logical drive(s).

To accept the proposed configuration and create the disk array and logical drive(s), highlight Save Configuration and press Enter.

To reject the proposed configuration, highlight Cancel Array Configuration and press Enter. You will return to the Disk Arrays Summary screen.

To create a disk array with different characteristics, highlight Create New Array and press Enter. Repeat the steps above specifying different parameters.

Creating a Disk Array – Advanced

For more information on the choices below, see “Chapter 7: Technology Background”

To create a disk array using the Advanced feature:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight Create New Array and press Enter.
3. Highlight Configuration Method and press the spacebar to toggle to Advanced.

- Choose whether to enable Media Patrol and PDM.

4. If you want to specify an alias to the disk array, highlight Alias and type a name.

- Maximum of 32 characters. Use letters, numbers, space between words and underscore.

5. Highlight Save Settings and Continue and press Enter.
6. Highlight a physical drive you want to add to your array and press the spacebar to select it.

- Repeat this action until you have selected all the physical drives for your array.

7. Highlight Save Settings and Continue and press Enter.
8. If you want to specify an alias to the logical drive, highlight Alias and type a name.

- Maximum of 32 characters. Use letters, numbers, space between words and underscore.

9. Highlight RAID Level and press the spacebar to toggle though a list of available RAID levels.

- If you want to create multiple logical drives, highlight Capacity, press the backspace key to remove the current value, then type a new smaller value.

10. Highlight Number of Axles and press the spacebar to select the number of axles. Applies to RAID 50 and 60 only.
11. Highlight Stripe and press the spacebar to toggle through stripe sizes and select 64 KB, 128 KB, 256 KB, 512 KB, or 1 MB.
12. Highlight Sector and press the spacebar to toggle through sector sizes and select 512 B, 1 KB, 2 KB, or 4 KB.
13. Highlight Write Policy and press the spacebar to toggle write cache policy between WriteBack and WriteThru (write though).
14. Highlight Read Policy and press the spacebar to toggle read cache policy though ReadCache, ReadAhead, and NoCache.
15. Highlight Preferred Controller ID and press the spacebar to toggle among 1, 2, or Automatic. Applies to dual-controller capable Fibre Channel models only.
16. Highlight Save Logical Drive and press Enter.
17. Review logical drive(s) you are about to create for your new array. Then do one of the following actions:
    - If you agree with the logical drive(s) as specified, highlight Complete Disk Array Creation and press Enter. A note will appear to remind you to set up LUN mapping for your new logical drive(s). Press any key to continue.
    - If you specified less than the full capacity for the logical drive in the previous screen, and you want to add another logical drive now, highlight Create New Logical Drive and press Enter.
    - If you do not agree with the logical drive(s), highlight Return to Previous Screen and press Enter to begin the process again.

Deleting a Disk Array

Caution

When you delete a disk array, you delete all the logical drives and the data they contain. Back up all important data before deleting a disk array.

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want to delete and press the spacebar to mark it.
- The mark is an asterisk (*) to the left of the listing.
3. Highlight Delete Marked Arrays and press Enter.
4. Press Y to confirm the deletion.

Viewing Disk Array Information

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
- The information and settings screen appears.
3. Highlight any of the following and press Enter to view a list of:
- Spare drives in this array, dedicated and global
- Physical drives in this array
- Logical drives in this array

Disk Array Operational Status

- OK – This is the normal state of a logical drive. When a logical drive is Functional, it is ready for immediate use. For RAID Levels other than RAID 0 (Striping), the logical drive has full redundancy.
- Synchronizing – This condition is temporary. Synchronizing is a maintenance function that verifies the integrity of data and redundancy in the logical drive. When a logical drive is Synchronizing, it will function and your data is available. However, access will be slower due to the synchronizing operation.
- Critical/Degraded – This condition arises as the result of a physical drive failure. A degraded logical drive will still function and your data is still available. However, the logical drive has lost redundancy (fault tolerance). You must determine the cause of the problem and correct it.
- Rebuilding – This condition is temporary. When a physical drive has been replaced, the logical drive automatically begins rebuilding in order to restore redundancy (fault tolerance). When a logical drive is rebuilding, it will function and your data is available. However, access will be slower due to the rebuilding operation.
- Transport Ready – After you perform a successful Prepare for Transport operation, this condition means you can remove the physical drives of this disk array and move them to another enclosure or different drive slots. After you relocate the physical drives, the disk array status will show OK.

Setting an Alias for a Disk Array

This function sets an alias for the disk array. To set an alias:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. To set an alias for this disk array, highlight Alias and type an alias into the field. Maximum of 32 characters. Use letters, numbers, space between words and underscore. An alias is optional.
4. Press Ctrl-A to save your settings.

Accepting an Incomplete Array

This condition is the result of a missing physical drive. See “Incomplete Array” in chapter 7. before you use this function.

To accept an incomplete array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. Highlight Accept Incomplete Array and press Enter.

Enabling Media Patrol on a Disk Array

Media Patrol checks the magnetic media on physical drives.

To run Media Patrol on a disk array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. Highlight Media Patrol and press the spacebar to toggle between Enable and Disable.
4. Press Ctrl-A to save your settings.

Enabling PDM on a Disk Array

This function enables and disables Predictive Data Migration (PDM).

To enable or disable PDM:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. Highlight PDM and press the spacebar to toggle between Enable and Disable.
4. Press Ctrl-A to save your settings.

See Running PDM below.

Preparing the Disk Array for Transport

To run the Transport function on a disk array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. Highlight Transport and press Enter.
4. Press Y to confirm.

Rebuilding a Disk Array

Before you can rebuild, you must have a replacement physical drive of adequate capacity or your disk array. To rebuild a disk array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. Highlight Background Activities and press Enter.
4. Highlight Rebuild and press Enter.
5. Specify the source and target physical drives.
6. Highlight Start and press Enter.

Migrating a Disk Array

In order to migrate RAID level, you may have to add physical drives. For more information, see “RAID Level Migration” in chapter 7..

To migrate a disk array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. Highlight Background Activities and press Enter.
4. Highlight Migration and press Enter.
5. Highlight the physical drive you want to add and press the spacebar to select it.

   Repeat this action to add more physical drives.

Notes

- You can add physical drives to a RAID 50 or 60 array but you cannot change the number of axles.
- If you add an odd number of physical drives to a RAID 10 array, it will become a RAID 1E array by default.

6. Highlight Save Settings and Continue and press Enter.
7. To change RAID level, Highlight the logical drive in the list and press Enter.
8. Highlight RAID Level and press the spacebar to toggle through the available RAID levels.
9. Optional. If you want to increase capacity, highlight Expand Capacity and press the spacebar to toggle to Yes.
10. Optional. If you want to increase capacity, highlight Capacity, press the backspace key to erase the current logical drive capacity and type in the new value. The new value must be equal or larger than the current capacity.
11. Highlight Save Logical Drive and press Enter. The screen returns to Disk Array Migration Logical Drives.
12. Highlight Complete Disk Array Migration and press Enter.

13. In the confirmation message, press Y to confirm.

    The screen jumps to Disk Arrays Summary.

Running PDM

Be sure PDM must be enabled. See Enabling PDM below.

To run Predictive Data Migration on a disk array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. Highlight Background Activities and press Enter.
4. Highlight Predictive Data Migration and press Enter.
5. Specify the source and target physical drives.
6. Highlight Start and press Enter.

Running Transition on a Disk Array

Transition is the process of replacing a revertible spare drive that is currently part of a disk array with an unconfigured physical drive or a non-revertible spare drive. For more information, see “Transition” in chapter 7..

In order to run Transition:

- The spare drive must be Revertible.
- You must have an unconfigured physical drive of the same or larger capacity to replace the spare drive.

To run Transition on a disk array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. Highlight Background Activities and press Enter.
4. Highlight Transition and press Enter.
5. Specify the source and target physical drives.
6. Highlight Start and press Enter.

Locating a Disk Array

This feature helps you identify the physical drives assigned to the disk array you are working with in the CLU.

To locate a disk array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array you want and press Enter.
3. Highlight Locate Disk Array and press Enter.

   The drive carrier LEDs pertaining to this disk array will blink for one minute.

Creating a Logical Drive

You can create logical drives on existing disk arrays if there is available space in the array. For more information on the choices below, see “Chapter 7: Technology Background”.

To create a logical drive from an existing disk array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array in which you want to create a logical drive and press Enter.
3. Highlight Create New Logical Drive and press Enter. The Disk Array ID number and Maximum capacity available for the new logical drive are displayed.
4. Highlight the following parameters and press the backspace key to erase the current value:

- Alias - Type an alias into the field, if desired. Maximum of 32 characters. Use letters, numbers, space between words and underscore.
- Capacity - Maximum capacity shown. Enter a smaller capacity if desired.

5. Highlight the following parameters and press the spacebar to toggle though the available choices:
   - Stripe size – Press the spacebar to select: 64 KB, 128 KB, 256 KB, 512 KB, or 1 MB
   - Sector size – Press the spacebar to select: 512 B; 1 KB, 2 KB, or 4 KB
   - Write Policy – Press spacebar to select: Write Back or Write Through
   - Read Policy – Press spacebar to select: No Cache, Read Cache, or Read Ahead Cache
6. Highlight Preferred Controller ID and press the spacebar to toggle among 1, 2, or Automatic. Applies to dual-controller capable Fibre Channel models only.
7. Highlight Number of Axles and press the spacebar to select the number of axles. Applies to RAID 50 and 60 only.
8. Press Ctrl-A to save your settings.

Note

If you did not use all of the available capacity of the disk array, you can create an additional logical drive at this point.

Deleting a Logical Drive

Caution

When you delete a logical drive, you delete all the data it contains. Back up all important data before deleting a logical drive.

To delete a logical drive from a disk array:

1. From the Main Menu, highlight Disk Array Management and press Enter.
2. Highlight the disk array that contains the logical drive you want to delete and press Enter.
3. Highlight the logical drive you want to delete and press the spacebar to mark it. The mark is an asterisk (*) to the left of the listing.
4. Highlight Delete Marked Logical Drives and press Enter.
5. Press Y to confirm the deletion.

5.8 Managing Logical Drives

The Logical Drive Management function deals with settings and functions of existing logical drives. To create or delete a logical drive, see

5.7 Managing Disk Arrays below. Logical drive management includes:

- Viewing Logical Drive Information
- Setting an Alias for a Logical Drive
- Setting Write Cache Policy
- Setting Read Cache Policy
- Setting Preferred Controller ID
- Initializing a Logical Drive
- Running Redundancy Check
- Locating a Logical Drive

Viewing Logical Drive Information

To view logical drive information:

1. From the Main Menu, highlight Logical Drive Management and press Enter.
2. Highlight the logical drive you want and press Enter. The information and settings screen appears.
3. Highlight any of the following and press Enter to view more information:
   - Check Table – Read Check, Write Check, and Inconsistency Check Tables
   - Logical Drive Statistics

Setting an Alias for a Logical Drive

To set an alias for a logical drive:

1. From the Main Menu, highlight Logical Drive Management and press Enter.
2. Highlight the logical drive you want and press Enter.
3. To set an alias for this disk array, highlight Alias and type an alias into the field.

   Maximum of 32 characters. Use letters, numbers, space between words and underscore. An alias is optional.
4. Press Ctrl-A to save your settings.

Setting Write Cache Policy

To set write cache policy on a logical drive:

1. From the Main Menu, highlight Logical Drive Management and press Enter.
2. Highlight the logical drive you want and press Enter.
3. To set write cache policy for this disk array, highlight WritePolicy and press the spacebar to toggle between WriteBack and WriteThru (write though).
4. Press Ctrl-A to save your settings.

Setting Read Cache Policy

To set read cache policy on a logical drive:

1. From the Main Menu, highlight Logical Drive Management and press Enter.
2. Highlight the logical drive you want and press Enter.
3. To set read cache policy for this disk array, highlight ReadPolicy and press the spacebar to toggle though ReadCache, ReadAhead and None.
4. Press Ctrl-A to save your settings.

Setting Preferred Controller ID

This feature applies to dual-controller capable Fibre Channel models only.

To set the preferred controller for this logical drive:

1. From the Main Menu, highlight Logical Drive Management and press Enter.
2. Highlight the logical drive you want and press Enter.

3. To set read cache policy for this disk array, highlight Preferred Controller ID and press the spacebar to toggle between 1 and 2.
4. Press Ctrl-A to save your settings.

Initializing a Logical Drive

This function sets all data bits in the logical drive to zero.

Caution

When you initialize a logical drive, you delete all the data it contains. Back up all important data before initializing a logical drive.

To initialize a logical drive:

1. From the Main Menu, highlight Logical Drive Management and press Enter.
2. Highlight the logical drive you want and press Enter.
3. Highlight Background Activity and press Enter.
4. Highlight Start Initialization and press Enter.

   The initialization parameters appear.

   - Initialization pattern. The default 00000000 is best for most applications
   - Quick Initialization – Yes means only the disk data format of the logical drives are initialized.
   - Quick Initialization Rate – Enter a value or use the default 64 bits.

   To change a parameter, highlight it and press the backspace key to erase the current value, then type the new value.
5. Highlight Start and press Enter.

If necessary, you can pause and resume or stop and restart the Initialization. You cannot access the logical drive until Initialization has finished.

Running Redundancy Check

Redundancy Check is a maintenance procedure for logical drives in fault-tolerant disk arrays that ensures all the data matches exactly. To run Redundancy Check:

1. From the Main Menu, highlight Logical Drive Management and press Enter.
2. Highlight the logical drive you want and press Enter.
3. Highlight Background Activity and press Enter.
4. Highlight Start Redundancy Check and press Enter.

   The redundancy check parameters appear.

   - Auto Fix – Corrects inconsistencies automatically
   - Pause On Error – Pauses the Redundancy Check when an error is found

   To change a parameter, highlight it and press the backspace toggle between Yes and No.
5. Highlight Start and press Enter.

If necessary, you can pause and resume or stop and restart the Redundancy Check. You can use the logical drive while Redundancy Check is running.

Locating a Logical Drive

This feature helps you identify the physical drives assigned to the logical drive you are working with in the CLU. To locate a logical drive:

1. From the Main Menu, highlight Logical Drive Management and press Enter.

2. Highlight the disk array you want and press Enter.
3. Highlight Locate Logical Drive and press Enter.
   The drive status LEDs for the physical drives in this logical drive will blink for one minute.

5.9 Managing the Network Connection

Network Management deals with network connections and settings for the Management Ports. Each Management Port can be configured:

- Making Subsystem Management Port Settings
- Making Controller Maintenance Mode Settings

Making Subsystem Management Port Settings

The Galaxy3G subsystem has a virtual management port. When you log into the Galaxy3G over your network, you use the virtual management port.

Before you change settings, please see “Choosing DHCP or a Static IP Address” in chapter 2..

Making Automatic Settings

1. From the Main Menu, highlight Network Management and press Enter.
2. Highlight the Virtual management port and press Enter.
3. Highlight NetMgmt Ethernet Port Settings and press Enter
4. Highlight DHCP and press the spacebar to toggle to Enabled.
5. Press Ctrl-A to save your settings.

Making Manual Settings

1. From the Main Menu, highlight Network Management and press Enter.
2. Highlight the Virtual management port and press Enter.
3. Highlight NetMgmt Ethernet Port Settings and press Enter
4. Highlight DHCP and press the spacebar to toggle to Disabled.
5. Highlight each of the following and press the backspace key to erase the current value, then type the new value.
   - IP Address
   - Subnet Mask
   - Default Gateway IP Address
   - DNS Server IP Address
6. Press Ctrl-A to save your settings.

Making Controller Maintenance Mode Settings

The controller has an IP addresses for access when the controller goes into maintenance mode. Maintenance mode is only for remedial action in the event of a problem with the controller. See “Controller Enters Maintenance Mode” in chapter 7. for more information.

Before you change settings, please see “Choosing DHCP or a Static IP Address” in chapter 2..

Making Automatic Settings

1. From the Main Menu, highlight Network Management and press Enter.
2. Highlight Maintenance Mode Network Configuration and press Enter.
3. Highlight the controller you want and press Enter.
4. Highlight DHCP and press the spacebar to toggle to Enabled.
5. Press Ctrl-A to save your settings.

Making Manual Settings

1. From the Main Menu, highlight Network Management and press Enter.
2. Highlight Maintenance Mode Network Configuration and press Enter.
3. Highlight the controller you want and press Enter.

4. Highlight DHCP and press the spacebar to toggle to Disabled.
5. Highlight each of the following and press the backspace key to erase the current value, then type the new value.
   - IP Address
   - Subnet Mask
   - Default Gateway IP Address
   - DNS Server IP Address
6. Press Ctrl-A to save your settings.

5.10 Managing Fibre Channel Connections

The Fibre Channel Management option appears only with Galaxy3G Fibre Channel models. Fibre Channel Management includes the following functions:

- Viewing Node Information
- Viewing Fibre Channel Logged-in Devices
- Making Fibre Channel Port Settings
- Viewing SFP Information
- Viewing Fibre Channel Port Statistics
- Viewing Fibre Channel Initiators
- Adding a Fibre Channel Initiator

Viewing Node Information

These functions affect both Galaxy3G Fibre Channel ports.

1. From the Main Menu, highlight Fibre Channel Management and press Enter.
2. Highlight Fibre Channel Node and press Enter.

Node information appears. There are no user settings on this screen.

Viewing Fibre Channel Logged-in Devices

To view a list of logged-in devices:

1. From the Main Menu, highlight Fibre Channel Management and press Enter.
2. Highlight Fibre Channel Ports and press Enter.
3. Highlight Fibre Channel Port 1 or Port 2 and press Enter.
4. Highlight Logged In Devices and press Enter.

If a Fibre Channel switch is attached, it will also appear in this list.

Making Fibre Channel Port Settings

To make Fibre Channel port settings:

1. From the Main Menu, highlight Fibre Channel Management and press Enter.
2. Highlight Fibre Channel Ports and press Enter.
3. Highlight Fibre Channel Port 1 or Port 2 and press Enter.
4. Highlight Fibre Channel Port Settings and press Enter.
5. Highlight the following parameters and press the spacebar to toggle though the choices:
   - Configured Link Speed – 1 Gb/s, 2 Gb/s, 4 Gb/s, or Automatic selection
   - Configured Topology – NL-Port (Arbitrated Loop), N-Port (Point to Point) or Automatic selection
6. Highlight Hard ALPA and press the backspace key to erase the current value, then type the new value.

   The range is 0 to 255. 255 disables this feature.
7. Press Ctrl-A to save your settings.

The table below shows the type of attached topology you will achieve based on your connection type and the configured topology you select:

Fibre Channel Attached Topology		
	Configured Topology	
Connection Type	N-Port	NL-Port
Switch	Fabric Direct	Public Loop
Direct	Point to Point	Private Loop

Example 1: If you connect the Galaxy3G to a Fibre Channel switch and select NL-Port topology, you will create a Public Loop attached topology.

Example 2: If you have a Point to Point attached topology, you made a direct connection (no switch) and selected N-port topology.

Note

In some cases, HBA settings to N-Port only work if connected to the switch. Refer to your HBA manual for more information.

Viewing SFP Information

To view information about the SFPs (small form-factor plugable transceivers):

1. From the Main Menu, highlight Fibre Channel Management and press Enter.
2. Highlight Fibre Channel Ports and press Enter.
3. Highlight Fibre Channel Port 1 or Port 2 and press Enter.
4. Highlight Fibre Channel Port SFP and press Enter.

The screen displays information about the SFP transceiver. There are no user settings on this screen.

Viewing Fibre Channel Port Statistics

To view port statistics:

1. From the Main Menu, highlight Fibre Channel Management and press Enter.
2. Highlight Fibre Channel Ports and press Enter.
3. Highlight Fibre Channel Port 1 or Port 2 and press Enter.
4. Highlight Fibre Channel Port Statistics and press Enter.

This screen displays statistics for this port. There are no user settings on this screen.

Viewing Fibre Channel Initiators

1. From the Main Menu, highlight Fibre Channel Management and press Enter.
2. Highlight Fibre Channel Initiators and press Enter.

A list of initiators appears.

To create an initiator, see Creating an Initiator below.

Adding a Fibre Channel Initiator

You must add an initiator to the Galaxy3G's initiator list in order to use the initiator to create a LUN for your logical drive.

To add an initiator:

1. From the Main Menu, highlight Fibre Channel Management and press Enter.
2. Highlight Fibre Channel Initiators and press Enter.
3. Highlight the initiator you want to add and press the spacebar to select it.
4. Highlight Add Marked Initiators and press Enter.

The initiator is added to Galaxy3G's initiator list.

5.11 Managing SAS Connections

The SAS Management option appears only with Galaxy3G Serial Attached SCSI models. SAS Management includes the following functions:

- **Error! Not a valid bookmark self-reference.**ort Information
- Making SAS Port Settings
- Viewing SAS Port Statistics
- Viewing SAS Initiators
- Adding a SAS Initiator

Viewing SAS Port Information

There are two SAS ports on each controller. To view information about the SAS ports:

1. From the Main Menu, highlight SAS Management and press Enter.
2. Highlight SAS Ports and press Enter.
3. Highlight the port you want to see and press Enter.

The port information appears on the screen.

Adjustable Items

- Cable Signal Strength

See Making SAS Port Settings.

Making SAS Port Settings

There are two SAS ports on each controller. To make settings to the SAS ports:

1. From the Main Menu, highlight SAS Management and press Enter.
2. Highlight SAS Ports and press Enter.
3. Highlight the port you want to see and press Enter.
4. Highlight SAS Port Settings and press Enter.
5. Highlight Cable Signal Strength, press the backspace key to erase the current value, then type in the new value.

   The range is 1 to 8. 1 is the default. Signal strength correlates to cable length in meters. Example: If you have a 2 m SAS cable, set signal strength to 2. If performance is unsatisfactory (see Viewing SAS Port Statistics), try settings of 1 and 3, then use the best setting for your system.
6. Press Ctrl-A to save your settings.

Viewing SAS Port Statistics

There are two SAS ports on each controller. To view information about the SAS ports:

1. From the Main Menu, highlight SAS Management and press Enter.
2. Highlight SAS Ports and press Enter.
3. Highlight the port you want to see and press Enter.
4. Highlight SAS Port Statistics and press Enter.

The statistics for the selected port appear on the screen.

Viewing SAS Initiators

There are two SAS ports on each controller, for a total of four SAS ports. To a view a list of initiators currently logged any of the four SAS ports:

1. From the Main Menu, highlight SAS Management and press Enter.
2. Highlight SAS Initiators and press Enter.

A list of all currently logged-in initiators appears on the screen.

Adding a SAS Initiator

You must add an initiator to the Galaxy3G's initiator list in order to use the initiator to create a LUN for your logical drive.

To add an initiator:

1. From the Main Menu, highlight SAS Management and press Enter.
2. Highlight SAS Initiators and press Enter.
3. Highlight the initiator you want to add and press the spacebar to select it.
4. Highlight Add Marked Initiators and press Enter.

The initiator is added to Galaxy3G's initiator list.

5.12 Managing Background Activity

Background activity refers to any of several functions that take place in the background while normal operation of the Galaxy3G continues.

Background activities work in conjunction with disk arrays and logical drives. See

5.7 Managing Disk Arrays and

5.8 Managing Logical Drives for more information about how and when to use background activities.

Background Activity Management includes the following functions:

- Viewing Current Background Activities
- Making Bctivity Settings

Viewing Current Background Activities

From the Main Menu, highlight Background Activity and press Enter. A count of current background activities appears, including:

- Rebuild
- PDM – Predictive Data Migration
- Synchronization
- Redundancy Check
- Migration
- Transition
- Initialization
- Media Patrol

Making Background Activity Settings

1. From the Main Menu, highlight Background Activity and press Enter.
2. Highlight Background Activity Settings and press Enter.
3. Highlight following and press the spacebar to toggle between Enabled and Disabled.
   - Media Patrol – Checks the magnetic media on physical drives
   - Auto Rebuild – If there is a spare drive of adequate capacity, a critical disk array will begin to rebuild automatically. If not spare drive is available, the disk array will begin to rebuild as soon as you replace the failed physical drive with an unconfigured physical drive of equal or greater size.
4. Highlight following and press the spacebar to toggle through Low, Medium, and High rates:
   - Rebuild – Checks the data integrity on disk arrays
   - Migration – Change RAID level or add physical dries to disk arrays
   - PDM – Looks for bad blocks on the physical drives of disk arrays
   - Transition – Returns a revertible spare drive to spare status
   - Synchronization – Checks the data integrity on disk arrays
   - Initialization – Sets all data bits in the logical drive to zero
   - Redundancy Check – Checks, reports and can correct data inconsistencies in logical drives

   The rates are defined as follows:
   - Low – Fewer resources to activity, more to data read/write.
   - Medium – Balance of resources to activity and data read/write.
   - High – More resources to activity, fewer to data read/write.
5. Highlight the following PDM trigger settings and press the backspace key to erase the current value:
   - Reassigned Block Threshold – 1 to 512 blocks
   - Error Block Threshold – 1 to 1024 blocks
6. Press Ctrl-A to save your settings.

5.13 Working with the Event Viewer

The Event Viewer displays log of subsystem events. Events are classified as:

- Runtime Events – A list of and information about the 1023 most recent runtime events recorded since the subsystem was started
- NVRAM Events – A list of and information about most important events over multiple subsystem startups. NVRAM events are stored in non-volatile memory

Working with the Event Viewer includes the following functions:

- Viewing Runtime Events
- Clearing Runtime Events
- Viewing NVRAM Events
- Clearing NVRAM Events

Viewing Runtime Events

To display Runtime Events:

1. From the Main Menu, highlight Event Viewer and press Enter.

   The log of Runtime Events appears. Events are added to the top of the list. Each item includes:

   - Sequence number – Begins with 0 at system startup.
   - Device – Disk Array, Logical Drive, Physical Drive by its ID number.
   - Severity – (lowest to highest) Information, Warning, Minor, Major, Critical and Fatal
   - Timestamp – Date and time the event happened.
   - Description – A description of the event in plain language.

- Press the up and down arrow keys to scroll through the log.

Clearing Runtime Events

To clear the Runtime Event log:

1. From the Main Menu, highlight Event Viewer and press Enter.
2. Highlight Clear Runtime Event Log and press Enter.
3. Press Y to confirm.

Viewing NVRAM Events

This screen displays a list of and information about 63 most important events over multiple subsystem startups.

To display NVRAM events:

1. From the Main Menu, highlight Event Viewer and press Enter.
2. Highlight NVRAM Events and press Enter.

   The log of NVRAM Events appears. Events are added to the top of the list. Each item includes:

   - Sequence number – Begins with 0 at system startup.
   - Device – Disk Array, Logical Drive, Physical Drive by its ID number.
   - Severity – (lowest to highest) Information, Warning, Minor, Major, Critical and Fatal
   - Timestamp – Date and time the event happened.
   - Description – A description of the event in plain language.

3. Press the up and down arrow keys to scroll through the log.

Clearing NVRAM Events

To clear the Runtime Event log:

1. From the Main Menu, highlight Event Viewer and press Enter.
2. Highlight NVRAM Events and press Enter.

3. Highlight Clear NVRAM Event Log and press Enter.
4. Press Y to confirm.

5.14 Managing Spare Drives

Spare Drive Management includes the following functions:

- Viewing a list of Spare Drives
- Creating a Spare Drive
- Making Spare Drive Settings
- Running Spare Check

Deleting a Spare Drive

Caution

If the spare drive you delete is the only spare, the controller will not rebuild a critical array until you provide a new spare drive.

Viewing a list of Spare Drives

To view a list of spare drives:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Spare Drive Management and press Enter.

A list of the current spare drives appears, including the following parameters:

- ID number
- Operational Status
- Physical Drive ID number
- Configured Capacity
- Revertible – The spare drive returns to spare status after you replace the failed drive in the disk array. See “Transition” in chapter 7 for more information.
- Type – Global (all disk arrays) or Dedicated (to specified disk arrays)
- Dedicated to Array – The array to which a dedicated spare is assigned

Creating a Spare Drive

Only unconfigured physical drives can be used to make spares. Check your available drives under Physical Drive Management. See

5.6 Managing Physical Drives.

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Spare Drive Management and press Enter.
3. Highlight Create New Spare Drive and press Enter.
4. Highlight Physical Drive Number and press the backspace key to erase the current value, then type the new value.
   - Specify the number of the physical drive you want for your spare. The available drive numbers are in parentheses.
5. Highlight Revertible and press the spacebar to toggle between Yes and No.
   - A revertible drive can be returned to spare status after you replace the failed drive in a disk array. See “Transition” in chapter 7 for more information.
6. Highlight Spare Type and press the spacebar to toggle between Dedicated and Global.
   - Dedicated means this spare drive can only be used with the specified disk arrays. Global means this spare drive can be used by any disk array.
   - If you chose Dedicated, highlight Dedicated to Arrays and press the backspace key to erase the current value, then type the new value.

Specify the number(s) of the disk array(s) you want to assign your spare. The current disk arrays are listed in parentheses.

8. Press Ctrl-A to save the spare drive.

Making Spare Drive Settings

To change spare drive settings:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Spare Drive Management and press Enter.

   A list of the current spare drives appears, including the following parameters:
3. Highlight the spare drive you want to change and press Enter.
4. Highlight the setting you want to change:
   - Revertible – A revertible drive can be returned to spare status after you replace the failed drive in a disk array. See “Transition” in chapter 7.for more information.
   - Type – Dedicated means this spare drive can only be used with the specified disk array(s). Global means this spare drive can be used by any disk array.
5. Press the spacebar to toggle between the choices.
6. For dedicated spares, type the array number the spare is assigned to.
7. Press Ctrl-A to save your settings.

Running Spare Check

To run Spare Check:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Spare Drive Management and press Enter.
   - A list of the current spare drives appears.
3. Highlight the spare drive you want to check and press Enter.
4. Highlight Start Spare Check and press Enter.

The results appear next to Spare Check Status.

Deleting a Spare Drive

Caution

If the spare drive you delete is the only spare, the controller will not rebuild a critical array until you provide a new spare drive.

1. Highlight the spare drive you want to delete and press the spacebar to mark it.
   The mark is an asterisk (*) to the left of the listing.
2. Highlight Delete Marked Spare Drives and press Enter.
3. Press Y to confirm the deletion.

5.15 Working with LUN Mapping

LUN Mapping includes the following functions:

- Viewing a List of Initiators
- Enabling LUN Mapping
- Creating an Initiator
- Mapping a LUN to an Initiator
- Deleting an Initiator

Viewing a List of Initiators

LUN Mapping must be enabled in order for Galaxy3G to recognize a Fibre Channel or SAS initiator. To view a list of initiators:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight LUN Mapping and press Enter.

A list of the current initiators appears.

Enabling LUN Mapping

To enable LUN mapping:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight LUN Mapping and press Enter.

A list of the current Fibre Channel or SAS initiators appears.

LUN Mapping must be enabled in order for Galaxy3G to recognize the initiator. If LUN Mapping is currently disabled, highlight Enable LUN Mapping and press Enter.

Creating an Initiator

You must add an initiator to the Galaxy3G's initiator list in order to use the initiator to create a LUN. You can also add initiators under Fibre Channel Management see Adding a Fibre Channel Initiator or SAS Management, see Adding a SAS Initiator

To create (add) a new initiator:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight LUN Mapping and press Enter.
3. Highlight Create New Initiator and press Enter.
4. Type the name of the initiator.
    - Fibre Channel – A Fibre Channel initiator name is the World Wide Port Name of the device and is composed of a series of eight, two-digit hexadecimal numbers.
    - SAS – A SAS initiator name is the SAS address of the HBA card in the Host PC. Obtain the initiator name from the initiator utility on your host system.
5. Obtain the initiator name from the initiator utility on your host system.
    - Note that the initiator name you input must match exactly in order for the connection to work.
6. Press Ctrl-A to save the initiator.

Note

LUN Mapping must be enabled in order for Galaxy3G to recognize the initiator.

Mapping a LUN to an Initiator

You must add an initiator to the Galaxy3G's initiator list in order to use the initiator to create a LUN. You can add initiators under Fibre Channel Management see Adding a Fibre Channel Initiator, under SAS Management, see Adding a SAS Initiator or Creating an Initiator.

To map a LUN to an initiator:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight LUN Mapping and press Enter.
3. Highlight an existing Initiator and press Enter.
   - A list of logical drives displays.
4. In the LUN field, press the backspace key to erase the current value, then type the LUN you want to assign to this initiator, from 0 to 255.
   - If you make a error, press Ctrl-R to restore the current LUN.
5. Press Ctrl-A to save the LUN map.

Deleting an Initiator

To delete an initiator:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight LUN Mapping and press Enter.
3. Highlight the initiator you want to delete and press the spacebar to mark it. The mark is an asterisk (*) to the left of the listing.
4. Highlight Delete Marked Initiators and press Enter.
5. Press Y to confirm the deletion.

5.16 Managing Users

User Management includes the following functions:

- Viewing User Information
- Creating a User
- Changing a User's Password
- Changing a User's Display Name and Email Address
- Changing a User's Privilege and Status
- Deleting a User

Viewing User Information

Each user types their user name and password to log into the CLI.

To view a list of current user accounts:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight User Management and press Enter.

A list of the current users appears.

Creating a User

To create a new user account:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight User Management and press Enter.
3. Highlight Create New User and press Enter.
4. Highlight each field and type in the appropriate information:
    - User name (no spaces)
    - Password (Optional. Maximum 32 characters. Use letters, numbers, space between words and underscore)
    - Display name (Optional)
5. Highlight Privilege and press the space bar to toggle though the options:
    - For definitions of each privilege level, see the List of User Privileges below.
6. Highlight Status and press the space bar to toggle between the options:
    - Enabled – Allows the user to log in to the system
    - Disabled – Prevents the user from logging in to the system
7. Press Ctrl-A to save the user.

List of User Privileges

- **View** – Allows the user to see all status and settings but not to make any changes
- **Maintenance** – Allows the user to perform maintenance tasks including Rebuilding, PDM, Media Patrol, and Redundancy Check
- **Power** – Allows the user to create (but not delete) disk arrays and logical drives, change RAID levels, change stripe size; change settings of components such as disk arrays, logical drives, physical drives, and the controller.
- **Super** – Allows the user full access to all functions including create and delete users and changing the settings of other users, and delete disk arrays and logical drives. The default "administrator" account is a Super User.

Changing a User's Password

Each user can change their own password. A Super user can change other user's passwords. To change a user's password:

1. From the Main Menu, highlight Additional Info and Management and press Enter.

2. Highlight User Management and press Enter.
3. Highlight a User in the list and press Enter.
4. Highlight Change Password… and press Enter.
5. Highlight New Password and type the password.
6. Highlight Retype Password and type the password again to verify.
7. Press Ctrl-A to save the password.

Changing a User's Display Name and Email Address

Each user can change their display name and email address. To change a display name or email address:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight User Management and press Enter.
3. Highlight a User in the list and press Enter.
4. Highlight Display Name and press Enter.
5. Highlight the items you want and press the backspace key to erase the current value, then type the new value:
    - User name
    - Email address
6. Press Ctrl-A to save the settings.

Changing a User's Privilege and Status

No user can change their own privilege or status. To change another user's privilege or status.

Log in as the Administrator or a Super user.

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight User Management and press Enter.
3. Highlight a User in the list and press Enter.
4. Highlight Display Name and press Enter.
5. Highlight Privilege and press the space bar to toggle though the options:
    - For definitions of each privilege level, see List of Users below.
6. Highlight Status and press the space bar to toggle between the options:
    - Enabled – Allows the user to log in to the system
    - Disabled – Prevents the user from logging in to the system
7. Press Ctrl-A to save the settings.

Deleting a User

To delete a user:

Log in under a user name other than the one you want to delete.

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight User Management and press Enter.
3. Highlight the user you want to delete and press the spacebar to mark it. The mark is an asterisk (*) to the left of the listing.
4. Highlight Delete Marked Users and press Enter.
5. Press Y to confirm the deletion.

5.17 Working with Software Management

Software Management includes the following functions:

- Making Email Settings
- Making SLP Settings
- Making Webserver Settings
- Making Telnet Settings
- Making SNMP Settings
- Managing SNMP Trap Sinks
- Making CIM Settings
- Making Netsend Settings
- Managing Netsend Recipients

Making Email Settings

By default, Email service is set to Automatic and its normal status is Started.

To make Email service settings:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.
3. Highlight Email and press Enter.
4. Highlight Startup Type and press the spacebar to toggle between Automatic and Manual.
5. Highlight the following and press the backspace key to erase the current value, then type the new value:
    - Server IP address
    - Server Port number – 25 is the default
6. Highlight Authentication and press the spacebar to toggle between Yes and No.

If you selected Yes, type in a User name and Password in the fields provided.

The following items are optional but recommended. Highlight and press the backspace key to erase the current value, then type the new value:

- Sender's email address
- Subject Line for the email message
- Press Ctrl-A to save your settings.

To start, stop or restart the Email service, highlight Start, Stop or Restart and press Enter.

Making SLP Settings

By default, SLP service is set to Automatic and its normal status is Started.

To make SLP service settings:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.
3. Highlight SLP and press Enter.
4. Highlight Startup Type and press the spacebar to toggle between Automatic and Manual.
5. Press Ctrl-A to save your settings.

To start, stop or restart the SLP service, highlight Start, Stop, or Restart and press Enter.

Making Webserver Settings

By default, Webserver service is set to Automatic and its normal status is Started.

To make Webserver service settings:

1. From the Main Menu, highlight Additional Info and Management and press Enter.

2. Highlight Software Management and press Enter.
3. Highlight Webserver and press Enter.
4. Highlight Startup Type and press the spacebar to toggle between Automatic and Manual.
5. Highlight the following and press the backspace key to erase the current value, then type the new value:
    - HTTP Port – 80 is the default
    - Session Time Out – 24 minutes is the default. 1440 minutes = 24 hours
6. Highlight SSL and press the spacebar to toggle between Enabled and Disabled.
7. Highlight HTTPS Port and press the backspace key to erase the current value, then type the new value. 443 is the default.
8. Press Ctrl-A to save your settings.

To start, stop or restart the Webserver service, highlight Start, Stop, or Restart and press Enter.

Making Telnet Settings

By default, Telnet service is set to Automatic and its normal status is Started. To make Telnet service settings:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.
3. Highlight Telnet and press Enter.
4. Highlight Startup Type and press the spacebar to toggle between Automatic and Manual.
5. Highlight the following and press the backspace key to erase the current value, then type the new value:

- Port number – 2300 is the default
- Session Time Out – 24 minutes is the default. 1440 minutes = 24 hours
- Maximum number of connections – 4 is the default

6. Press Ctrl-A to save your settings.

To start, stop or restart the Telnet service, highlight Start, Stop, or Restart and press Enter.

Making SNMP Settings

By default, SNMP (Simple Network Management Protocol) service is set to Automatic and its normal status is Started.

To make SNMP service settings:

From the Main Menu, highlight Additional Info and Management and press Enter.

Highlight Software Management and press Enter.

1. Highlight SNMP and press Enter.
2. Highlight Startup Type and press the spacebar to toggle between Automatic and Manual.
3. Highlight the following and press the backspace key to erase the current value, then type the new value:
    - Port Number – 161 is the default
    - System Name – (optional) Type a system name in this field
    - System Location – Type a country name in this field
    - System Contact – Type the email address of your system administrator in this field
    - Read Community – Type a community name in this field
    - Write Community – private (no change possible)
4. Press Ctrl-A to save your settings.

To start, stop or restart the SNMP service, highlight Start, Stop, or Restart and press Enter.

Managing SNMP Trap Sinks

Creating a SNMP trap sink

To create a trap sink:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.
3. Highlight SNMP and press Enter.
4. Highlight Trap Sinks and press Enter.

A list of the current trap sinks appears.

Adding a trap sink

To add a trap sink:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.
3. Highlight Create New Trap Sink and press Enter
4. Highlight Trap Sink IP address and press the backspace key to erase the current value, then type the new IP address in this field.
5. Highlight Trap Filter and press the spacebar to toggle through the severity levels. The Severity Levels are (lowest to highest) Information, Warning, Minor, Major, Critical and Fatal.
6. Press Ctrl-A to save the Trap Sink.

Deleting a trap sink

To delete a trap sink:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.
3. Highlight the trap sink you want to delete and press the spacebar to mark it.
4. The mark is an asterisk (*) to the left of the listing.
5. Highlight Delete Marked Entries and press Enter.

Making CIM Settings

By default, CIM (Common Information Model [a protocol]) service is set to Automatic and its normal status is Started.

To make CIM service settings:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.
3. Highlight CIM and press Enter.
4. Highlight Startup Type and press the spacebar to toggle between Automatic and Manual.
5. Highlight HTTP and press the spacebar to toggle between Enabled and Disabled.
6. Highlight HTTP Port, press the backspace key to erase, type new value. 5988 is the default port number.
7. Highlight HTTPS and press the spacebar to toggle between Enabled and Disabled.
8. Highlight HTTPS Port, press the backspace key to erase, type new value. 5989 is the default port number.
9. Highlight Authentication and press the spacebar to toggle between Enabled and Disabled.

Note: There is only one user. The default name is **cim**. No changes are possible.

Note: CIM service must be running to change the password. The default password is **password**.

a. Highlight Change Password… and press Enter to change the password.

b. Highlight Old Password and type the current password.

c. Highlight New Password and type a new password.

d. Highlight Retype Password and type the new password again.

e. Press Ctrl-A to save your settings.

To start, stop or restart the CIM service, highlight Start, Stop, or Restart and press Enter.

Making Netsend Settings

By default, Netsend service is set to Manual and its normal status is Stopped.

To make Netsend service settings:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.
3. Highlight Netsend and press Enter.
4. Highlight Startup Type and press the spacebar to toggle between Automatic and Manual.
5. Press Ctrl-A to save your settings.

To start, stop or restart the Netsend service, highlight Start, Stop, or Restart and press Enter.

Managing Netsend Recipients

Note that the Messenger service must be running on the recipient PC in order to receive reports.

Adding a recipient

To add a recipient:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.
3. Highlight Netsend and press Enter.
4. Highlight Message Recipient and press Enter.
5. Highlight Create New Message Recipient and press Enter.
6. Type the recipient's IP address into the field provided.
7. Highlight Message Event Severity Filter and press the spacebar to change severity levels.
8. The selected level and all higher severity levels of severity will be reported. Severity levels (from lowest to highest) are: Info, Warning, Minor, Major, Critical, and Fatal.
9. Press Ctrl-A to save your settings.

Changing Recipient Settings

To change recipient settings:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Software Management and press Enter.

Highlight the recipient whose settings you want to change and press Enter.

3. Type the recipient's IP address into the field provided.
4. Highlight Message Event Severity Filter and press the spacebar to change severity levels.
5. Press Ctrl-A to save your settings.

Deleting a Recipient

To delete a recipient:

From the Main Menu, highlight Additional Info and Management and press Enter.

Highlight Software Management and press Enter.

Highlight the recipient you want to delete and press the spacebar to mark it.

1. The mark is an asterisk (*) to the left of the listing
2. Highlight Delete Marked Entries and press Enter.

NetSend Requirements

In order to use NetSend:

- NetSend must be running on the Galaxy3G
- You must provide the IP address for each recipient PC
- The Messenger service must be running on each recipient PC

If your NetSend and Messenger service settings are correct but the recipient PC does not receive event messages, check the recipient PC's Firewall settings. Refer to your OS documentation for more information.

5.18 Flashing through TFTP

Use this function to flash the Galaxy3G's firmware. See "Updating the Firmware in the CLU" in chapter 7 for this procedure.

5.19 Clearing Statistics

This function clears the statistical counts for the RAID controller, Fibre Channel ports, SAS ports, physical drives, and logical drives. To clear statistics:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Clear Statistics and press Enter.
3. Press Y to confirm the deletion.

5.20 Restoring Factory Defaults

This function restores the factory default settings to the firmware and software items you select.

Caution

Use this function with care. Do not restore to default settings for any item unless you are sure this action is needed.

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Restore Factory Defaults and press Enter.
3. Highlight the setting group you want and press the spacebar to toggle between Yes and No.
   Yes means this setting will be restored to the default value.
4. Highlight Restore Factory Defaults and press Enter.
5. Press Y to confirm the reset.

5.21 Shutting Down the Subsystem

There are two methods for shutting down the subsystem. Choose one of the following procedures:

- Shutting down the Galaxy3G – Telnet Connection
- Shutting down the Galaxy3G – Serial Connection

Shutting down the Galaxy3G – Telnet Connection

This function enables you to shutdown the Galaxy3G subsystem on a Telnet connection. You can only do part of this procedure in the CLU. Additional action is required, as described below. To shutdown the Galaxy3G:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Shutdown or Restart and press Enter.
3. Highlight Shutdown or Restart and press Enter.
4. Highlight Option and press the spacebar to display Restart.
5. Highlight Submit and press Enter.

   A warning message appears.
6. Press Y to continue.

   The screen will go blank.
7. Wait for no less than two minutes.
8. Manually turn off the power supply switches on the back of the subsystem.

Shutting down the Galaxy3G – Serial Connection

This function enables you to shutdown the Galaxy3G subsystem on a serial connection. You can only do part of this procedure in the CLU. Additional action is required, as described below. To shutdown the Galaxy3G:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Shutdown or Restart and press Enter.
3. Highlight Shutdown or Restart and press Enter.
4. Highlight Option and press the spacebar to display Restart.
5. Highlight Submit and press Enter.

   A warning message appears.
6. Press Y to continue.
7. Turn off the power supply switches when you see the following message:

   Shutdown complete. It is now safe to power off the subsystem.

5.22 Restarting the Subsystem

There are two methods for restarting the subsystem. Choose one of the following procedures:

-

5.22 Restarting the S

- Restarting Galaxy3G – Serial Connection

Restarting Galaxy3G – Telnet Connection

This function enables you to restart the Galaxy3G subsystem on a Telnet connection. You can only do part of this procedure in the CLU. Additional action is required, as described below. To restart the Galaxy3G:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Shutdown or Restart and press Enter.
3. Highlight Option and press the spacebar to display Restart.
4. Highlight Submit and press Enter.

   A warning message appears.
5. Press Y to continue.

   The screen will go blank.
6. Wait for no less than two minutes.
7. Re-establish your Telnet connection to the Galaxy3G CLU.

   If you cannot re-establish a connection, wait 30 seconds, then try again.

Restarting Galaxy3G – Serial Connection

This function enables you to restart the Galaxy3G subsystem on a serial connection. You can only do part of this procedure in the CLU. Additional action is required, as described below. To restart the Galaxy3G:

1. From the Main Menu, highlight Additional Info and Management and press Enter.
2. Highlight Shutdown or Restart and press Enter.
3. Highlight Option and press the spacebar to display Restart.
4. Highlight Submit and press Enter.

   A warning message appears.
5. Press Y to continue.

   The screen will display shutdown and startup functions.
6. When the **Login:** prompt appears, log into the CLU again.

5.23 Configuring Buzzer Settings

This function enables the buzzer on the controller. When you first power-up the Galaxy3G, it beeps twice to show normal operation. To change buzzer settings:

1. From the Main Menu, highlight Buzzer and press Enter.

   A list of Controllers appears with the current buzzer setting and status.
2. Highlight the Controller whose buzzer you want to set and press Enter.
3. Highlight Enabled and press the spacebar to toggle between Yes and No.
4. Press Ctrl-A to save your settings.

The buzzer provides the audible alarm. See “Galaxy3G is Beeping” in chapter 7..

Section 6
Maintenance

6.0 Maintenance

This chapter covers the following topics:

- 6.1 Updating the Firmware with GAM
- 6.2 Updating the Firmware with CLU
- 6.3 Replacing a Power Supply
- 6.3 Replacing a Power Supply
- 6.5 Replacing a Cache Battery
- 6.6 Replacing a RAID Controller

6.1 Updating the Firmware with GAM

A firmware update consists of the following actions:

- Restarting the Subsystem
- Updating Firmware from TFTP Server
- Updating Firmware from your PC

Downloading the Firmware Image File

On the rare condition that firmware would need to be replaced, we have provided a utility to change the firmware image. Contact Galaxy Support and download the latest firmware image (.img) file to your TFTP server or your PC. The firmware update image file includes all of the files for the Galaxy3G, including:

- Firmware
- Software
- Kernel
- RedBoot
- Other files

Updating Firmware from your PC

Note

We strongly suggest that you use this procedure to do the Galaxy3G firmware update. The other update procedures are more complicated and require 3rd party software.

To update the firmware from your PC:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click on the Software Management icon.

4. Click on the Firmware Update tab.
5. Do one of the following actions:
   - Click on the Download Flash File from Local File through HTTP option, then click on the Next button.
   - From the Firmware Update tab dropdown menu, select *Download from Local File*.
6. Enter the filename of the Firmware Update file in the field provided.

   Or, click the **`Browse...`** button and select the Firmware Update file in the Open dialog box.
7. Click the **`Submit`** button.
8. When the download is completed, click the **`Next`** button.

   A popup message appears to warn you not to reboot the Galaxy3G during the firmware update procedure.
9. In the popup message, click the **`OK`** button.

   The update progress displays. Then a popup message appears to tell you to reboot the Galaxy3G.
10. In the popup message, click the **`OK`** button.
11. Restart the Galaxy3G. See **Restarting the S**.

Note

After you click the **`Submit`** button, if GAM displays this message: **`error transferring image`**, you entered an incorrect file name or an incorrect location. Check the information and try again.

Updating Firmware from TFTP Server

Note

3rd Party TFTP server software is required. Free versions of TFTP Server software are available on the web. Contact Galaxy support to use this procedure to update the Galaxy3G.

To update the firmware from a TFTP server:

1. Click the Subsystem icon in Tree View.
2. Click the Administrative Tools icon.
3. Click on the Software Management icon.
4. Click on the Firmware Update tab.
5. Do one of the following actions:
   - Click on the Download from TFTP Server option, then click on the **`Next`** button.
   - From the Firmware Update tab dropdown menu, select *Download from TFTP Server*.

6. Enter the hostname or IP address of your TFTP server in the field provided.
7. Enter the port number of your TFTP server in the field provided (69 is the default).
8. Enter the filename of the Firmware Update file in the field provided.
9. Click the **Submit** button.
10. When the download is completed, click the **Next** button.

    A popup message appears warning you not to reboot the Galaxy3G during the firmware update procedure.
11. In the popup message, click the **OK** button.

    The update progress displays. Then a popup message appears to tell you to reboot the Galaxy3G.
12. In the popup message, click the **OK** button.
13. Restart the Galaxy3G. See **Restarting the S**.

Note

After you click the **Submit** button, if GAM displays this message: **error transferring image**, you entered an incorrect file name or an incorrect location. Check the information and try again.

Restarting the Subsystem

Warning

Do not restart the Galaxy3G during a firmware upgrade procedure. Wait until the upgrade is one and you are prompted to restart.

To restart the Galaxy3G subsystem:

1. Click on the Subsystem icon in Tree View.
2. Click on the Administrative Tools icon.
3. Click on the Shutdown link in Management View.

   A Shutdown or Restart tab will appear.
4. On the Shutdown or Restart tab, select `Restart` from the dropdown menu.
5. Click the **Submit** button.
6. In the warning box, click the **OK** button.
7. In the confirmation box, type the word **confirm** in the field provided.
8. Click the **OK** button.

   When the controller shuts down, your GAM connection will be lost.
9. Wait for two to three minutes.
10. In your browser, log into GAM once again.

    If you cannot log in, wait for 30 seconds, and try again. Repeat until login is successful.

6.2 Updating the Firmware in the CLU

A firmware update consists of the following actions:

- Downloading the Firmware Image File
- Updating the Firmware
- Restarting Subsystem over a Telnet Connection
- Restarting Subsystem over a Serial Connection

Downloading the Firmware Image File

Contact Galaxy support and download the latest firmware image file to your TFTP server.

Updating the Firmware

To update the firmware file in the CLU:

1. From the Main Menu, highlight Additional Info and Management, and press Enter.
2. Highlight Flash through TFTP and press Enter.
3. Highlight TFTP Server and type the IP address of your TFTP server in the field provided.
4. Highlight Port Number and press the backspace key to erase the current value, then type the new value. 69 is the default.

   A list of the current users appears.
5. Highlight File Name and type the file name of the firmware image file in the field provided.
6. Highlight Start and press Enter.

   A message appears to tell you to reboot the Galaxy3G.
7. Restart the Galaxy3G.

Restarting Subsystem over a Telnet Connection

Warning

Do not restart the Galaxy3G during a firmware upgrade procedure. Wait until the upgrade is one and you are prompted to restart.

To restart the Galaxy3G subsystem on a Telnet connection:

1. From the Main Menu, highlight Additional Info and Management, and press Enter.
2. Highlight Shutdown or Restart and press Enter.
3. Press the spacebar to display Restart then press Enter.

   A warning message appears.
4. Press Y to continue.

   The screen will go blank.
5. Wait for two to three minutes.
6. Re-establish your Telnet connection to the Galaxy3G CLU.

   If you cannot re-establish a connection, wait 30 seconds, then try again.

Restarting Subsystem over a Serial Connection

Warning

Do not restart the Galaxy3G during a firmware upgrade procedure. Wait until the upgrade is one and you are prompted to restart.

To restart the Galaxy3G subsystem on a serial connection:

1. From the Main Menu, highlight `Additional Info and Management`, and press Enter.
2. Highlight `Shutdown or Restart` and press Enter.
3. Press the spacebar to display `Restart` then press Enter.
   A warning message appears.
4. Press Y to continue.
   The screen will display shutdown and startup functions.
5. When the `Login:` prompt appears, log into the CLU again.

6.3 Replacing a Power Supply

The power supply and its fans are replaced as one unit. There are no individually serviceable parts. No tools are required for this procedure.

Remove the Old Power Supply

To remove the power supply:

1. Verify that the power supply LED is amber or red.
2. Switch off the power.
3. Unplug the power cord.
4. Press the release button and pull the handle downward as shown. See
5. Pull the power supply out of the Galaxy3G enclosure.

Install a New Power Supply

To install the power supply:

1. Carefully slide the power supply into the enclosure.
2. Gently press the handle in and upward until it locks. See
3. Plug in the power cord.
4. Switch on the power supply.
5. Verify that the new power supply LED is green.

This completes the power supply replacement procedure

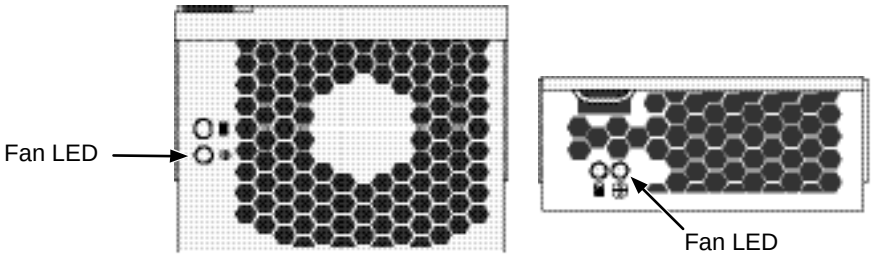
Fig 6.3a Replacing G3G Power Supply

6.4 Replacing a Cooling Unit Blower

The blower (scroll fan) in each cooling unit is replaced as an individual part. No tools are required for this procedure.

Remove and Replace a Blower

To replace a blower:



1. Verify that the Fan LED is amber or red.

2. Press the release button and pull the handle downward. See **Error! Reference source not found.**
3. Pull the cooling unit out of the Galaxy3G enclosure

Fig 6.4a G3G 16 bay cooling unit removal

Fig 6.4c Removing the cooling unit access cover

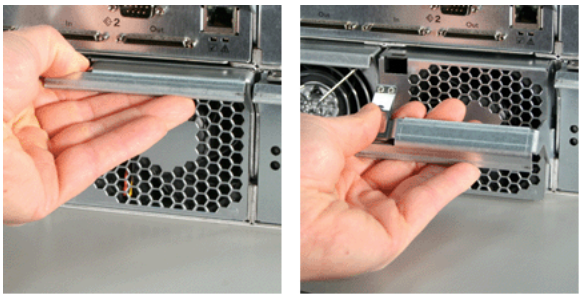
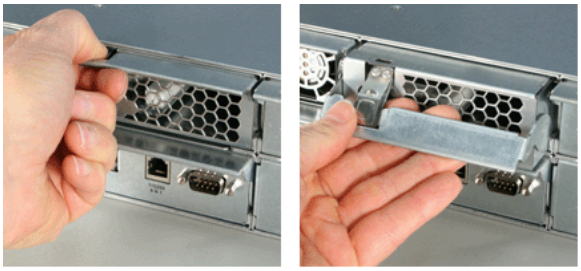
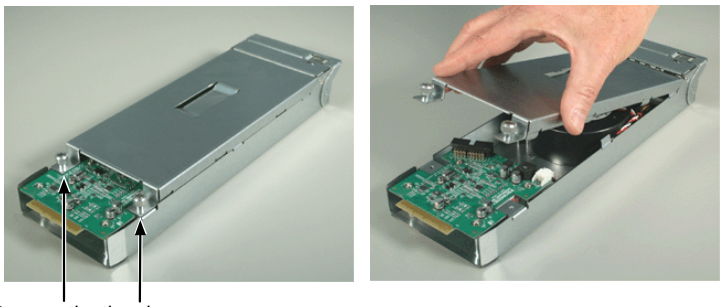


Fig 6.4b G3G 12 bay cooling unit removal



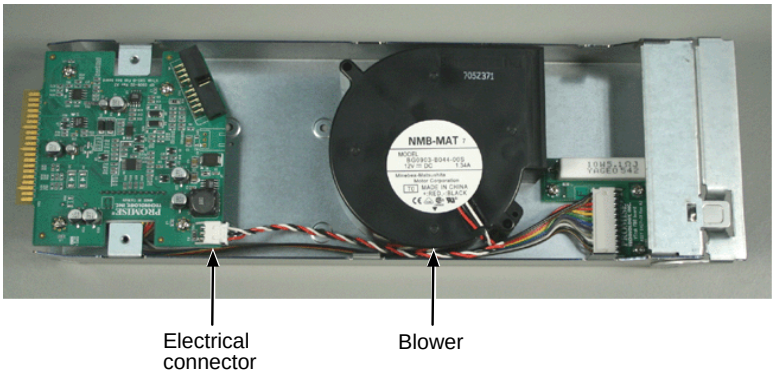
4. Loosen the thumbscrew. A retainer keeps the thumbscrew in place.
5. Grasp the top section near the thumbscrews and lift it off the bottom section. Separate the cooling unit



section to access the blower. See picture below

6. Lift the blower off the mounting pins and detach the electrical connector.
7. Attach the electrical connector of the new blower and set the blower in place.

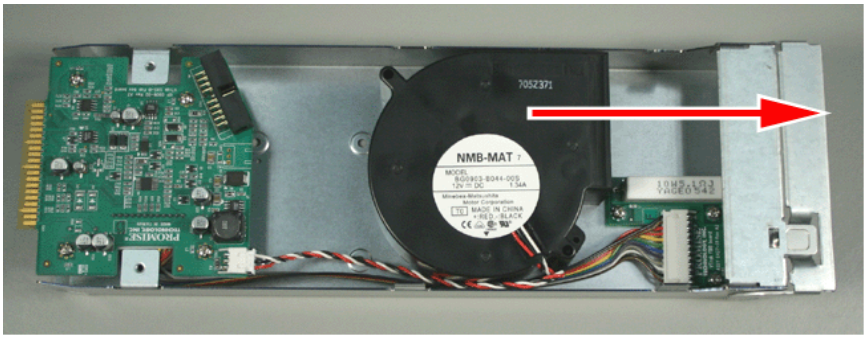
Fig 6.4d G3G cooling unit blower components



Be sure you position the blower onto the mounting pins. See **Error! Reference source not found.**

Be sure the blower points outward, towards the handle.

Fig 6.4e Positioning the replacement blower



8. Place the top section of the cooling unit onto the bottom section and tighten the thumbscrews.
9. Carefully slide the cooling unit into the enclosure.
10. Gently press the handle in and upward until it locks.
11. Verify that the Fan LEDs are green.

This completes the blower replacement procedure.

6.5 Replacing a Cache Battery

The cache battery is located inside the Cooling Unit. The battery is replaced as an individual part.

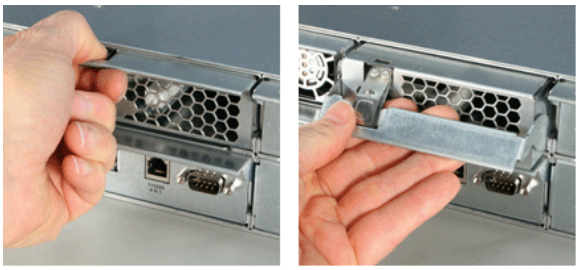
Cautions

- Try reconditioning the battery before you replace it.
- The battery assembly is replaced as a unit. Do not attempt to disconnect the battery by itself.
- Installing the wrong replacement battery can result in an explosion.
- Dispose of used batteries according to the instructions that accompany the battery.
- While the battery is removed, your system will be vulnerable to data loss if the power fails while data is being written to the logical drives.
- If power service has failed, do not remove the cooling unit if the Controller's Dirty Cache LED is flashing. See "Browser Does Not Connect to GAM" in Chapter 7.

To replace a cache battery:

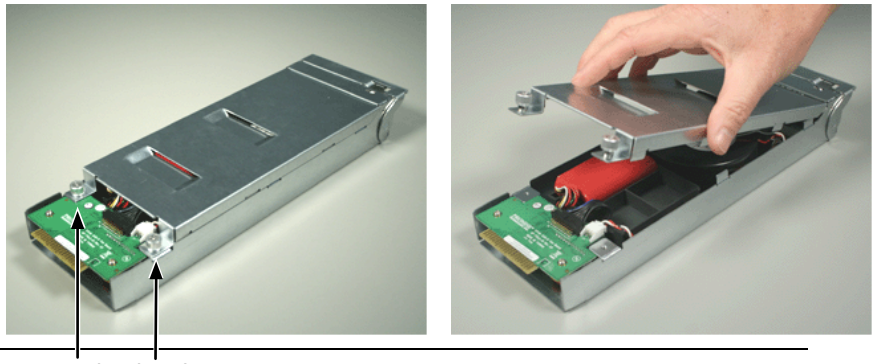
1. Press the release button and pull the handle downward as shown above.
2. Pull the cooling unit out of the Galaxy3G enclosure.

Fig 6.5a Removal of the cooling unit



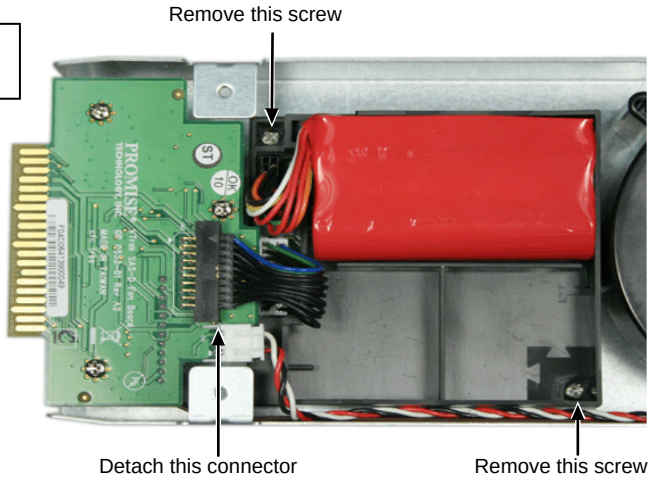
3. Loosen the thumbscrew. A retainer keeps the thumbscrew in place.
4. Grasp the top section near the thumbscrews and lift it off the bottom section. Separate the cooling unit section to access the blower.

Fig 6.5b Removing Access cover



5. Remove the two screws holding the battery assembly in place.
6. Detach the connector on the circuit board.
   Do not detach any other connectors.
7. Lift the battery assembly out of the cooling unit.

Fig 6.5c Disassembly of cache battery



8. Place a new battery assembly into the cooling unit.
9. Attach the connector on the circuit board.
10. Install the two screws holding the battery assembly in place to the cooling unit.
11. Place the top section of the cooling unit onto the bottom section and tighten the thumbscrews.
12. Carefully slide the cooling unit into the enclosure.
13. Gently press the handle in and upward until it locks.

Fig 6.5d Replacing the cooling unit

This completes the battery replacement procedure.

6.6 Replacing a RAID Controller

The RAID Controller is field-replaceable. But you can only hot-swap a controller if you have two controllers installed in your Galaxy3G enclosure.

Important

Do not replace the RAID Controller based on LED colors alone. Only replace the RAID Controller when directed to do so by Galaxy Technical Support. See Chapter 7.

Dual Controller Subsystem

Before you install the replacement controller, be sure the replacement controller has:

- The same Firmware version as the original controller
- The same amount of SDRAM as the original controller

To obtain this information, click on the Controller icon, Information tab, and look for Firmware Version and Memory Size.

Removing the old controller

To remove a RAID Controller on a dual-controller subsystem:

1. Disconnect the Fibre Channel or SAS cables, management, serial, and power cables.
2. On the controller handle, press the release button and pull the handle downward. See
3. Pull the controller out of the Galaxy3G enclosure.

Installing the new controller

To install the new controller:

1. Carefully slide the controller into the enclosure.
2. Gently press the handle in and upward until it locks. See
3. Connect the Fibre Channel or SAS cables, management, serial, and power cables.

Single Controller Subsystem

Removing the old controller

To remove the RAID Controller on a single-controller subsystem:

1. Shutdown the Galaxy3G. See “Shutting Down the Subsystem” in chapter 3
2. Switch off the power.
3. Disconnect the Fibre Channel or SAS cables, management, serial and power cables.
4. On the controller handle, press the release button and pull the handle downward. See
5. Pull the controller out of the Galaxy3G enclosure.

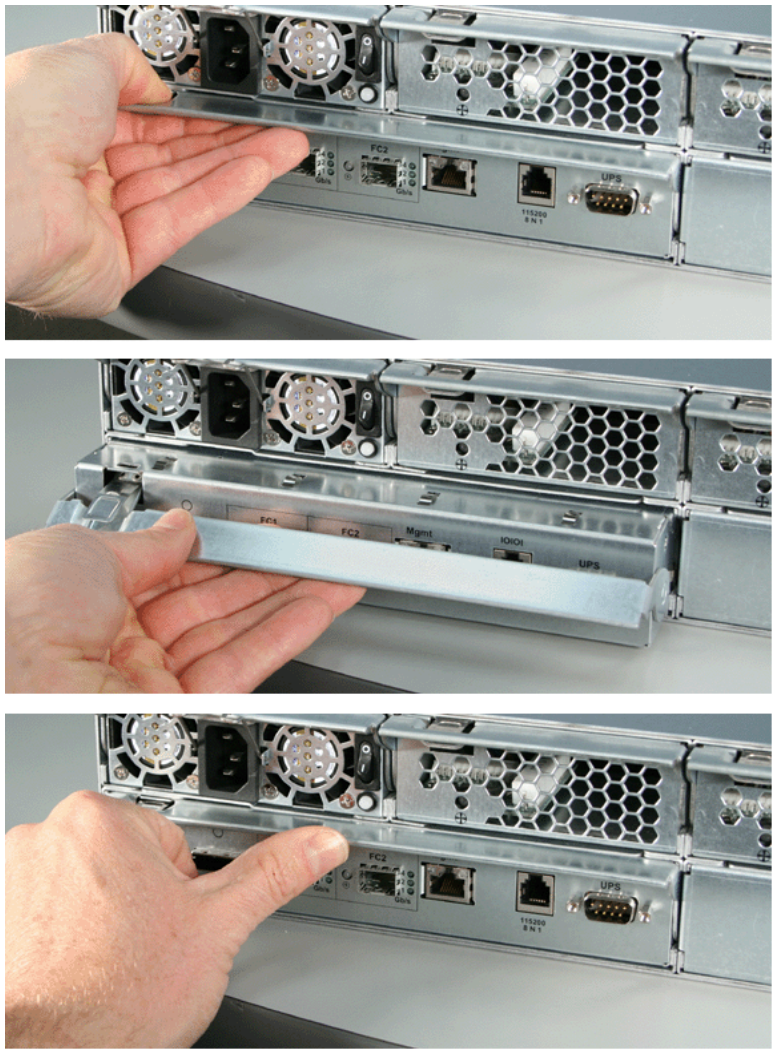
Installing the new controller

To install the new controller:

1. Carefully slide the controller into the enclosure.
2. Gently press the handle in and upward until it locks. See
3. Connect the Fibre Channel or SAS cables, management, serial and power cables.
4. Switch on the power.

   The Galaxy3G will restart. For more information about Galaxy3G’s start-up behavior, see “Connecting the Power” in chapter 2.

Fig 6.6a Removal of the G3G controller



Section 7
Technology Background

7.0 Technology Background

This chapter covers the following topics:

- 7.1 Introduction to RAID
- 7.2 Choosing a RAID Level
- 7.3 Choosing Stripe Size
- 7.4 Choosing Sector Size
- 7.5 Cache Policy
- 7.6 LUN Affinity
- 7.7 Capacity Coercion
- 7.8 Initialization
- 7.9 Hot Spare Drive(s)
- 7.10 Partition and Format the Logical Drive
- 7.11 RAID Level Migration
- 7.12 Media Patrol
- 7.13 Predictive Data Migration (PDM)
- 7.14 Transition

7.1 Introduction to RAID

RAID (Redundant Array of Independent Disks) allows multiple hard drives to be combined together in a disk array. Then all or a portion of the disk array is formed into a logical drive. The operating system sees the logical drive as a single storage device, and treats it as such. The RAID software and/or controller handle all of the individual drives on its own. The benefits of a RAID can include:

- Higher data transfer rates for increased server performance
- Increased overall storage capacity for a single drive designation (such as, C, D, E, etc.)
- Data redundancy/fault tolerance for ensuring continuous system operation in the event of a hard drive failure

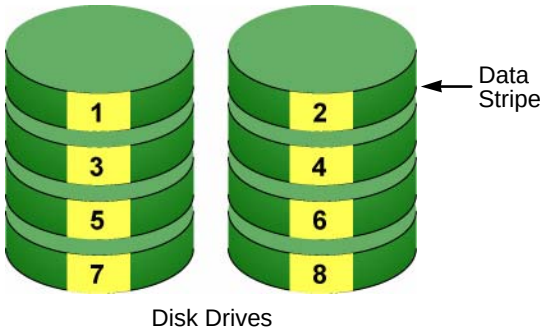
Different types of disk arrays use different organizational models and have varying benefits. Also see

7.2 Choosing a R. The following outline breaks down the properties for each type of RAID disk array:

RAID 0 –Stripe

When a disk array is striped, the read and write blocks of data are interleaved between the sectors of multiple drives. Performance is increased, since the workload is balanced between drives or “members” that form the disk array. Identical disk drives are recommended for performance as well as data storage efficiency. The disk array’s data capacity is equal to the number of disk drive members multiplied by the smallest drive's capacity

Fig 7.1a RAID 0 Striping interleaves data across multiple drives



For example, one 100 GB and three 120 GB drives will form a 400 GB (4 x 100 GB) disk array instead of 460 GB.

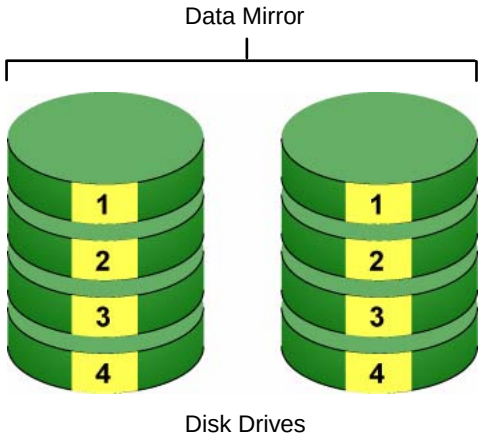
RAID 0 arrays require one or more physical drives.

Recommended applications: Video and Image Editing, Pre-Press Applications, and other applications requiring high bandwidth.

RAID 1 –Mirror

When a disk array is mirrored, identical data is written to a pair of drives, while reads are performed in parallel. The reads are performed using elevator seek and load balancing techniques where the workload is distributed in the most efficient manner. Whichever drive is not busy and is positioned closer to the data will be accessed first. With RAID 1, if one drive fails or has errors, the other mirrored drive continues to function. This is called Fault Tolerance. Moreover, if a spare drive is present, the spare drive will be used as the replacement drive and data will begin to be mirrored to it from the remaining good drive.

Fig 7.1b RAID 1 Mirrored identical data into 2 drives



Due to the data redundancy of mirroring, the drive capacity of the disk array is only the size of the smallest drive. For example, two 100 GB drives which have a combined capacity of 200 GB instead would have 100 GB of usable storage when set up in a mirrored disk array. Similar to RAID 0 striping, if drives of different capacities are used, there will also be unused capacity on the larger drive.

RAID 1 arrays use two physical drives. You can create multiple RAID 1 disk arrays on the Galaxy3Gt.

Recommended applications: Accounting, Payroll, Financial, other applications requiring very high availability.

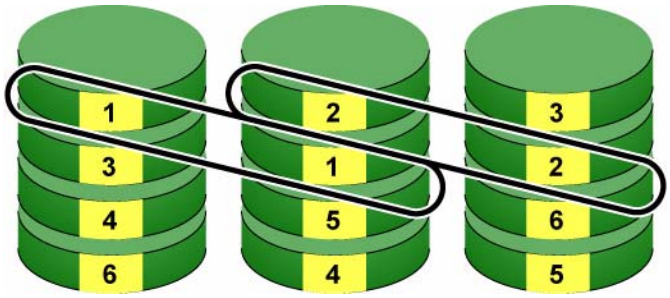
RAID 1E –Enhanced Mirror

RAID 1E offers the security of mirrored data provided by RAID 1 plus the added capacity of more than two disk drives. It also offers overall increased read/write performance plus the flexibility of using an odd number of disk drives. With RAID 1E, each data stripe is mirrored onto two disk drives. If one drive fails or has errors, the other drives continue to function, providing fault tolerance. The advantage of RAID 1E is the ability to use an odd number of disk drives, unlike RAID 1 and RAID 10. You can also create a RAID 1E Logical Drive with an even number of disk drives. However, if you have an even number of disks, you will obtain greater security with comparable performance using RAID 10.

RAID 1E arrays consist of three or more physical drives. You can create an array with just two physical drives and specify RAID 1E. But the resulting array will actually be a RAID 1.

Recommended applications: Imaging Applications, Database Servers, General Fileservers.

Enhanced Data Mirrors

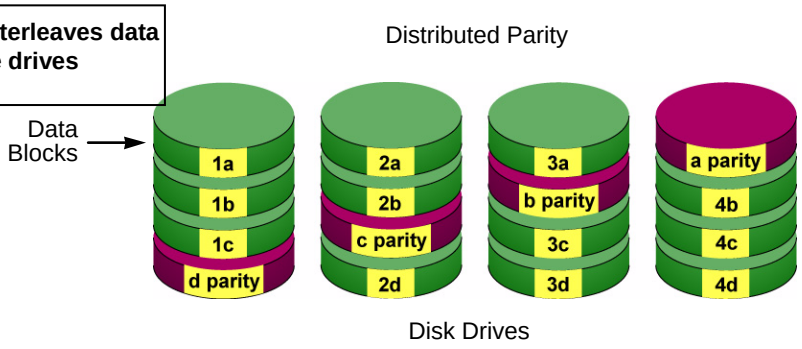


Disk Drives

RAID 5 –Block and Parity Stripe

RAID 5 organizes block data and parity data across the physical drives. Generally, RAID Level 5 tends to exhibit lower random write performance due to the heavy workload of parity recalculation for each I/O. RAID 5 is generally considered to be the most versatile RAID level

Fig 7.1c RAID 5 Striping interleaves data and parity across multiple drives



The capacity of a RAID 5 disk array is the smallest drive size multiplied by the number of drives less one. Hence, a RAID 5 disk array with four 100 GB hard drives will have a capacity of 300 GB. A disk array with eight 120 GB hard drives and one 100 GB hard drive will have a capacity of 800 GB.

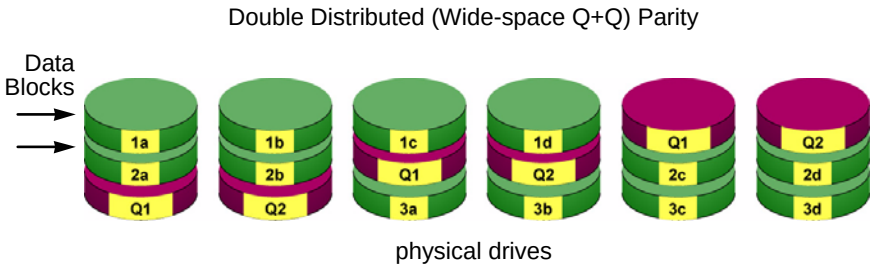
RAID 5 requires a minimum of three physical drives and a maximum of 16.

Recommended applications: File and Application Servers; WWW, E-mail, News servers, Intranet Servers

RAID 6 –Block and Double Parity Stripe

RAID level 6 stores dual parity data is rotated across the physical drives along with the block data. A RAID 6 disk array can continue to accept I/O requests when any two physical drives fail.

The total capacity of a RAID 6 disk array is the smallest physical drive times the number of physical drives, minus two.



Hence, a RAID 6 disk array with six 100 GB hard drives will have a capacity of 400 GB. A disk logical drive with four100 GB hard drives will have a capacity of 200 GB.

RAID 6 becomes more capacity efficient in terms of physical drives as the number of physical drives increases.

RAID 6 offers double fault tolerance. Your logical drive remains available when up to two physical drives fail.

RAID 6 is generally considered to be the safest RAID level, except for RAID 60.

RAID 6 requires a minimum of four physical drives and a maximum of 16.

Recommended applications: Video and imaging editing, Accounting, financial, and database servers; and any application requiring very high availability. Strongly recommended for SATA drive based RAIDs.

RAID 10 –Mirror + Stripe

Mirroring/striping combines both of the previous RAID 1 and RAID 0 disk array types. RAID 10 is similar though not identical to RAID 0+1. RAID 10 can increase performance by reading and writing data in parallel while protecting data with duplication. At least four drives are needed for RAID 10 to be installed. With four disk drives, the drive pairs are striped together with one pair mirroring the first pair. The data capacity is similar to a RAID 1 disk array, with half of the total storage capacity used for redundancy. An added plus for using RAID 10 is that, in many situations, such a disk array offers double fault tolerance. Double fault tolerance may allow your logical drive to continue to operate depending on which two disk drives fail.

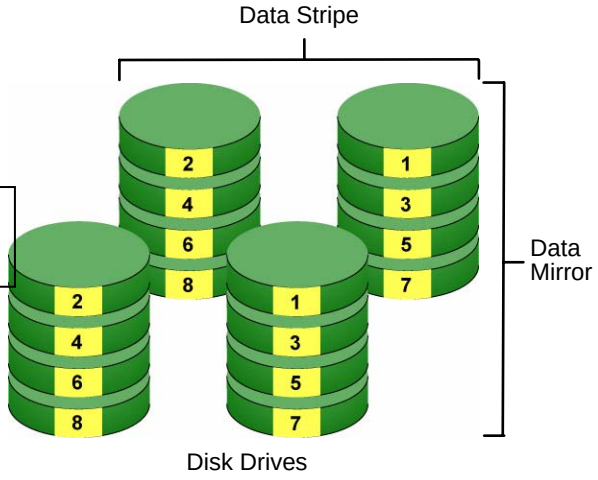


Fig 7.1d RAID 10 Mirrored strip sets of drives

RAID 10 arrays require an even number of physical drives and a minimum of four.

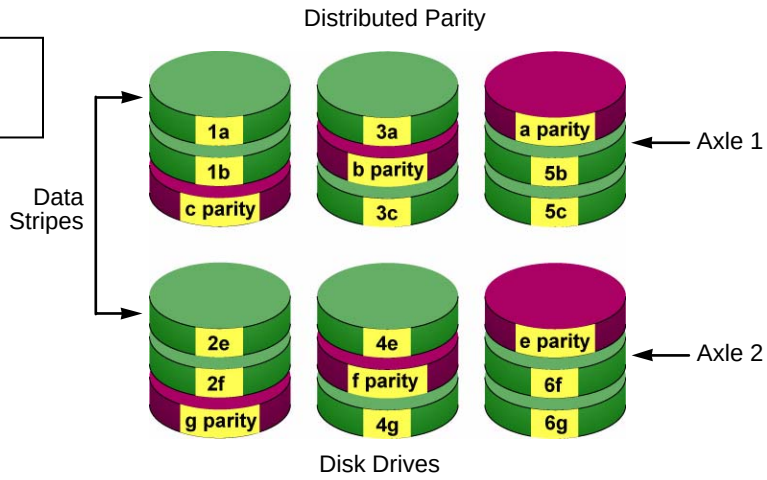
For RAID 10 characteristics with an odd number of disk drives, use RAID 1E.

Recommended applications: Imaging Applications, Database Servers, General Fileservers.

RAID 50 –Striping of Distributed Parity

RAID 50 combines both RAID 5 and RAID 0 features. Data is striped across disks as in RAID 0, and it uses distributed parity as in RAID 5. RAID 50 provides data reliability, good overall performance and supports larger volume sizes.

Fig 7.1e Striped sets of RAID 5



RAID 50 also provides high reliability because data is still available even if multiple disk drives fail (one in each axle). The greater the number of axles, the greater the number of disk drives that can fail without the RAID 50 array going offline.

RAID 50 arrays consist of six or more physical drives.

Using a Galaxy3G subsystem expanded by four JBOD subsystems, your RAID 50 array supports up to 60 physical drives. See “Configuring JBOD Expansion” in chapter 2. However, we recommend that you set aside a few physical drives as hot spares.

RAID 50 Axles

When you create a RAID 50, you must specify the number of axles. An axle refers to a single RAID 5 array that is striped with other RAID 5 arrays to make RAID 50. An axle can have from 3 to 16 physical drives, depending on the number of physical drives in the array.

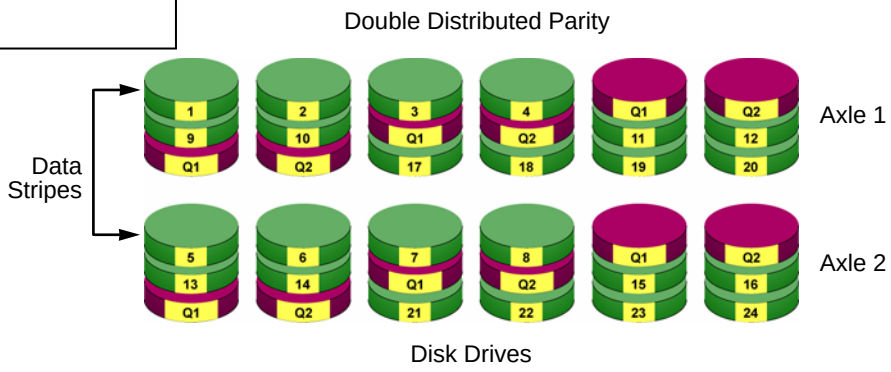
The chart below shows RAID 50 arrays with 6 to 16 physical drives, the available number of axles, and the resulting distribution of physical drives on each axle.

RAID 50 Array		
No. of Drives	**No. of Axles**	**Drives per Axle**
6	2	3,3
7	2	3,4
8	2	4,4
9	2	4,5
	3	3,3,3
10	2	5,5
	3	3,3,4
11	2	5,6
	3	3,4,4
12	2	6,6
	3	4,4,4
	4	3,3,3,3
13	2	6,7
	3	4,4,5
	4	3,3,3,4
14	2	7,7
	3	4,5,5
	4	3,3,4,4
15	2	7,8
	3	5,5,5
	4	3,4,4,4
	5	3,3,3,3,3
16	2	8,8
	3	5,5,6
	4	4,4,4,4
	5	3,3,3,3,4

RAID 60 –Striping of Double Parity

RAID 60 combines both RAID 6 and RAID 0 features. Data is striped across disks as in RAID 0, and it uses double distributed parity as in RAID 6. RAID 60 provides data reliability, good overall performance and supports larger volume sizes.

Fig 7.1f RAID 60: Striping axles of RAID 6



RAID 60 also provides very high reliability because data is still available even if multiple disk drives fail (two in each axle). The greater the number of axles, the greater the number of disk drives that can fail without the RAID 60 array going offline.

RAID 60 arrays consist of eight or more physical drives.

Using a Galaxy3G subsystem expanded with four JBOD subsystems, your RAID 60 array supports up to 60 physical drives. See “Configuring JBOD Expansion” in chapter 2. However, we recommend that you set aside a few physical drives as hot spares..

Recommended applications: Video and Imaging Editing, Accounting, financial, and database servers; and any application requiring very high availability. Strongly recommended for RAIDs using SATA disk drives.

RAID 60 Axles

When you create a RAID 60, you must specify the number of axles. An axle refers to a single RAID 6 array that is striped with other RAID 6 arrays to make RAID 60. An axle can have from 4 to 16 physical drives, depending on the number of physical drives in the array.

The chart below shows RAID 60 arrays with 8 to 20 physical drives, the available number of axles, and the resulting distribution of physical drives on each axle.

RAID 60 Array		
No. of Drives	**No. of Axles**	**Drives per Axle**
8	2	4,4
9	2	4,5
10	2	5,5
11	2	5,6
12	2	6,6
	3	4,4,4
13	2	6,7
	3	4,4,5
14	2	7,7
	3	4,5,5
15	2	7,8
	3	5,5,5
16	2	8,8
	3	5,5,6
	4	4,4,4,4
17	2	8,9
	3	5,6,6
	4	4,4,4,5
18	2	9,9
	3	6,6,6
	4	4,4,5,5
19	2	9,10
	3	6,6,7
	4	4,5,5,5
20	2	10,10
	3	6,7,7
	4	5,5,5,5
	5	4,4,4,4,4

7.2 Choosing a RAID Level

There are several issues to consider when choosing the RAID Level for your Galaxy3G disk array. The following discussion summarizes some advantages, disadvantages, and applications for each choice.

RAID 0

Advantages	Disadvantages
Implements a striped disk array, the data is broken down into blocks and each block is written to a separate disk drive I/O performance is greatly improved by spreading the I/O load across many channels and drives No parity calculation overhead is involved	Not a true RAID because it is not fault-tolerant The failure of just one drive will result in all data in an disk array being lost Should not be used in mission critical environments

Recommended Applications for RAID 0

- Video and Image Editing
- Pre-Press Applications
- Any application requiring high bandwidth

RAID 1

Advantages	Disadvantages
Simplest RAID storage subsystem design Can increase read performance by processing data requests in parallel since the same data resides on two different drives	Very high disk overhead - uses only 50% of total capacity

Recommended Applications for RAID 1

- Accounting
- Payroll
- Financial
- Any application requiring very high availability

RAID 1E

Advantages	Disadvantages

Implemented as a mirrored disk array whose segments are RAID 0 disk arrays High I/O rates are achieved thanks to multiple stripe segments Can use an odd number of disks	Very high disk overhead - uses only 50% of total capacity

Recommended Applications for RAID 1E

- Imaging applications
- Database servers
- General fileserver

RAID 5

Advantages	Disadvantages
High Read data transaction rate Medium Write data transaction rate Good aggregate transfer rate	Disk failure has a medium impact on throughput

Recommended Applications for RAID 5

- File and Application Servers
- Intranet, WWW, Email and News Servers
- General fileserver

RAID 6

Advantages	Disadvantages
High Read data transaction rate Medium Write data transaction rate Good aggregate transfer rate Safest RAID level, except for RAID 60	High disk overhead – equivalent of two drives used for parity Slightly lower performance than RAID 5

Recommended Applications for RAID 6

- Accounting and Financial
- Database servers
- Any application requiring very high availability
- Strongly recommended for SATA based disk RAIDs

RAID 10

Advantages	Disadvantages

Implemented as a mirrored disk array whose segments are RAID 0 disk arrays High I/O rates are achieved thanks to multiple stripe segments	Very high disk overhead - uses only 50% of total capacity

Recommended Applications for RAID 10

- Video and Imaging applications
- Database servers
- General fileserver

RAID 50

Advantages	Disadvantages
High Read data transaction rate Medium Write data transaction rate Good aggregate transfer rate High reliability Supports large volume sizes	Higher disk overhead than RAID 5

Recommended Applications for RAID 50

- File and Application servers
- Transaction processing
- Office application with many users accessing small files

RAID 60

Advantages	Disadvantages
High Read data transaction rate Medium Write data transaction rate Good aggregate transfer rate Safest RAID level	High disk overhead – equivalent of two drives used for parity Slightly lower performance than RAID 50

Recommended Applications for RAID 60:

- Strongly recommended for Video and Imaging Editing Applications using SATA based RAIDs
- Accounting and Financial
- Database servers
- Any application requiring very high availability

7.3 Choosing Stripe Size

Stripe Size, also called “Stripe Block Size”, refers to the size of the data blocks written to, and read from, the physical drives. Stripe Size is specified when you create a disk array. In order to change the Stripe Size of an existing disk array, you must delete the disk array and create a new one. You can select Stripe Size directly when you use the Advanced function to create a disk array. If you use the Express function to create a disk array, GAM selects the Stripe Size when you choose an Application Type.

The available Stripe Sizes are 64, 128, 256 KB, 512 KB, and 1 MB. 64 KB is the default. There are two issues to consider when selecting the Stripe Size.

First, you should choose a Stripe Size equal to, or smaller than, the smallest cache buffer found on any physical drive in the disk array. Selecting a larger value slows read/write performance because physical drives with smaller cache buffers need more time for multiple accesses to fill their buffers.

Second, if your data retrieval consists of fixed data blocks, such as with some database or video applications, then you should choose that size as your Stripe Size.

If you do not know the cache buffer or fixed data block sizes, we suggest you select 64 KB as your Stripe Size. Generally speaking, email, POS, and webservers prefer smaller stripe sizes. Video and database applications prefer larger stripe sizes.

7.4 Choosing Sector Size

A sector is the smallest addressable area on a physical disk drive. Sector Size refers to the size of sector measured by the number of bytes of data it can hold. The most common sector size is 512 bytes (512 B). A smaller sector size results in a more efficient use of a disk drive's capacity. 512 B is the default sector size for logical drives in the Galaxy3G.

The number of usable sectors is limited by the addressing method of the computer's operating system:

Windows 2000 and Windows XP (32-bit) support 10-bit logical bit addressing (LBA), so with 512 B sectors, they can only support up to 2 terabytes (TB) of data storage capacity. To increase the capacity, you must use larger sectors. See 2 TB Limitation

- .
- Windows XP (64-bit), Windows 2003 Server, and Windows Vista support 64-bit LBA, so they are not affected by this limitation. For these OSes, always choose the default 512 B sector size.
- Linux operating systems with the 2.4 kernel do not support variable sector sizes. For these OSes, always choose the default 512 B sector size.
- Linux operating systems with the 2.6 kernel support 64-bit LBA. For these OSes, always choose the default 512 B sector size.

2 TB Limitation

If your Host PC runs Windows 2000 or Windows XP (32-bit), and you want to create logical drives larger than 2TB, you must choose a sector size larger than 512 B when you create the logical drive. The table below correlates sector size with logical drive capacity.

Logical Drive Size	Sector Size
8 to 16 TB	4096 bytes (4 KB)
4 to 8 TB	2048 bytes (2 KB)
2 to 4 TB	1024 bytes (1 KB)
0 to 2 TB	512 bytes (512 B)

Because logical drives can be expanded, you may encounter a situation where the usable capacity of your expanded logical drive is reduced by the addressing issue described above. There are two alternatives:

- Limit your logical drive expansion to within the limits described in the chart.
- Back up your data, then delete your existing logical drive and create a new one with a larger sector size.

IMPORTANT!

Be aware that not all HBAs and their drivers are compatible with the OS to use the over 2TB functionality.

7.5 Cache Policy

As it is used with Galaxy3G, the term cache refers to any of several kinds of high-speed, volatile memory that hold data moving from your computer to the physical drives or vice-versa. Cache is important because it can read and write data much faster than a physical drive. There are read caches, which hold data as it is read from a physical drive; and write caches, which hold data as it is written to a physical drive.

In order to tune the cache for best performance in different applications, user-adjustable settings are provided. Cache settings are made in conjunction with logical drives:

- When you create a logical drive. See “Creating a Logical Drive” in chapter 4
- On an existing logical drive. See “Making Logical Drive Settings” in chapter 4

Read Cache Policy

- Read Cache – The read cache is enabled.
- Read Ahead – The read cache and the read-ahead feature are enabled. Read-ahead anticipates the next read and performs it before the request is made. Can increase read performance.
- No Cache – The read cache is disabled.

Write Cache Policy

- Write Back – Data is written first to the cache, then to the physical drive. Better performance. Galaxy3G has a cache backup battery to protect data in the cache from a sudden power failure.
- Write Thru – Also “Write Through”. Data is written to the cache and the physical drive at the same time. Safer.

If Write Policy is set to Write Back, and the cache backup battery goes offline, the Write Policy automatically changes to Write Thru. When the battery comes back online, the Write Policy automatically changes back to Write Back.

If Write Policy is set to Write Back, and the Adaptive Writeback Cache feature is enabled, the Write Policy will remain at Write Back even when the battery is offline. Any data in the controller cache will be lost in the event of a power failure.

Adaptive Writeback Cache

On the Galaxy3G subsystem, you can set the logical drive write cache policy to Write Through or Write Back.

If you set the write cache policy to Write Back, your data is first written to the controller cache, and later to the physical drive. This action improves performance. To preserve the data in the cache in the event of a power failure, the subsystem has a backup battery that powers the cache up to 72 hours.

Normally, if the cache backup battery is not present or the battery is being reconditioned, your logical drive write cache policy is automatically set to Write Through, so no data is stored in the controller cache. This action slightly reduces performance but avoids data loss in the event of a power failure. When a battery is installed or finishes reconditioning, the write cache policy is automatically reset to Write Back.

The Adaptive Writeback Cache option enables you to set your logical drive write cache policy to Write Back, even if no cache backup battery is present or the battery is being reconditioned. This action improves performance but also risks a loss of data in the event of a power failure.

To enable the Adaptive Writeback Cache option, click on the Controller Settings tab. See “Making Controller Settings”.

Also see “Replacing a Cache Battery”.

7.6 LUN Affinity

Galaxy3G Fibre Channel subsystems with two controllers include a LUN Affinity feature. Normally, either controller can access all logical drives. LUN Affinity enables you to specify which controller can access each logical drive. Use this feature to balance the load of your logical drives between the two controllers.

To use LUN Affinity you must:

- Have two controllers in the subsystem
- Enable LUN Affinity under controller settings.

Disk Array Creation

When you create a logical drive using the Advanced method of disk array creation, you can specify the Preferred Controller ID:

- Controller 1 – Assign all logical drives to Controller 1
- Controller 2 – Assign all logical drives to Controller 2
- Automatic – Alternate logical drive assignments between Controllers 1 and 2

Automatic is the default and preferred setting because it will balance the logical drive assignments for you.

When you create a logical drive using the Automatic or Express disk array creation, the logical drives are assigned alternatively between Controllers 1 and 2 automatically.

See “Creating a Disk Array – Automatic” , “Creating a Disk Array – Express” , or “Creating a Disk Array – Advanced” .

Logical Drive Settings

After you have created a logical drive, you can click on the Settings tab and manually change the Preferred Controller ID between Controller 1 and Controller 2. See “Making Logical Drive Settings”.

If you create logical drives with LUN Affinity disabled, the Preferred Controller ID will show N/A, and your logical drives will be visible to both controllers.

If you create logical drives with LUN Affinity disabled, and later you enable LUN Affinity, all of your logical drives will be assigned to Controller 1. To balance the load, you can reassign some of your logical drives to Controller 2 under the Preferred Controller ID in the Settings tab. See “Making Logical Drive Settings”.

When you a delete a logical drive, the remaining logical drives keep the same Controller assignments. If you want to rebalance controller assignments of the remaining logical drives, change their Preferred Controller IDs in the Settings tab.

Failover and Failback

When one controller fails, the surviving controller takes over logical drive access until the failed controller is brought back online or is replaced. For example, LUN Affinity is enabled and your logical drives are assigned to Controller 1. The following actions will happen:

- If Controller 1 goes offline, Controller 2 takes over access to the logical drives assigned to Controller 1.
- If Controller 1 comes back online, Controller 1 takes back access to the logical drives assigned to it.
- If Controller 1 is replaced, the new controller takes over access to the logical drives assigned to Controller 1.
- All logical drives assigned to Controller 2 remain accessible by Controller 2. Controller 1 cannot access them at any time.

7.7 Capacity Coercion

This feature is designed for fault-tolerant logical drives (RAID 1, 1E, 5, 10, 50, and 60). It is generally recommended to use physical drives of the same size in your disk arrays. When this is not possible, physical drives of different sizes will work but the system must adjust for the size differences by reducing or coercing the capacity of the larger drives to match the smaller ones. With Galaxy3G, you can choose to enable Capacity Coercion and any one of four methods.

Enable Capacity Coercion and select the Method in the Controller Settings menu.. The choices are:

- GB Truncate – (Default) Reduces the useful capacity to the nearest 1,000,000,000 byte boundary.
- 10GB Truncate – Reduces the useful capacity to the nearest 10,000,000,000 byte boundary.
- Group Rounding – Uses an algorithm to determine how much to truncate. Results in the maximum amount of usable drive capacity.
- Table Rounding – Applies a predefined table to determine how much to truncate.

Capacity Coercion also affects a replacement drive used in a disk array. Normally, when an physical drive fails, the replacement drive must be the same capacity or larger. However, the Capacity Coercion feature permits the installation of a replacement drive that is slightly smaller (within 1 gigabyte) than the remaining working drive. For example, the remaining working drives can be 80.5 GB and the replacement drive can be 80.3, since all are rounded down to 80 GB. This permits the smaller drive to be used.

Without Capacity Coercion, the controller will not permit the use of a replacement physical drive that is slightly smaller than the remaining working drive(s).

7.8 Initialization

Initialization is done to logical drives after they are created from a disk array. Initialization sets all data bits in the logical drive to zero. The action is useful because there may be residual data on the logical drives left behind from earlier configurations. For this reason, Initialization is recommended for all new logical drives. See “Initializing a Logical Drive” in chapter 4.

Caution

When you initialize a logical drive, all the data on the logical drive will be lost. Backup any important data before you initialize a logical drive.

7.9 Hot Spare Drive(s)

A hot spare is a disk drive that is connected to the disk array system but is not assigned as a member of the disk array. In the event of the failure of a drive within a functioning fault tolerant disk array, the hot spare is activated as a member of the disk array to replace a drive that has failed.

Galaxy3G will replace a failing disk drive in a disk array with an unassigned drive, if one is available. The unassigned drive is not part of any disk array. Such a drive is called a `hot spare` drive. There are two types:

- **`Global`** – An unassigned disk drive available to any disk array on the Galaxy3G.
- **`Dedicated`** – An unassigned disk drive that can only be used by a specified disk array.

The hot spare policy function lets you select whether a disk array will access any unassigned disk drive or a designated drive in the event of disk drive failure. See “Managing Spare Drives” in chapter 4 (GAM) for information on how to make this setting.

The spare drive effectively takes the place of the failed drive and the RAID system immediately begins to rebuild data onto the drive. When the rebuild is complete, the disk array is returned to fault tolerant status.

Galaxy3G includes a function that enables you to return a hot spare drive from a disk array back to spare status. When you create the hot spare drive, check the Revertible box to enable this feature. See

7.14 Transition.

See also “Critical & Offline Disk Arrays” in chapter 4.

7.10 Partition and Format the Logical Drive

Like any other type of fixed disk media in your system, a RAID logical drive must also be partitioned and formatted before use. Use the same method of partitioning and formatting on a logical drive as you would any other fixed disk.

Depending on the operating system you use, there may or may not be various capacity limitations applicable for the different types of partitions.

7.11 RAID Level Migration

To migrate a disk array is to do one or both:

- Change its RAID level
- Increase the number of disk drives (sometimes called Expansion)

Migration takes place on an existing Functional disk array without disturbing the existing data. While the disk array is migrating, you can access the data as before. When migration is complete, your disk array will have a different RAID level and/or a larger capacity.

Different types of disk arrays use different organizational models and have varying benefits. The following outline breaks down the properties for each type of RAID supported by the Galaxy3G.

From	To	Increase		Redundancy	
		Capacity	Performance	Add	Lose
RAID 50	RAID 10	•			
	RAID 5				•*
	RAID 1E		•		
	RAID 0	•	•		•
RAID 10	RAID 50	•			
	RAID 5	•			
	RAID 1E	•			
	RAID 0	•	•		•
RAID 6	RAID 50	•	•		•*
	RAID 10	•	•		•*
	RAID 5	•	•		•*
	RAID 1E	•	•		•*
	RAID 0	•	•		•
RAID 5	RAID 50			•	
	RAID 10	•	•		
	RAID 1E	•			

	RAID 0	•	•		•
RAID 1E	RAID 50	•			
	RAID 10	•			
	RAID 5	•			
	RAID 0	•			•
RAID 1	RAID 50	•	•		
	RAID 10	•			
	RAID 5	•	•		
	RAID 1E	•			
	RAID 0	•	•		•
RAID 0	RAID 50	•		•	
	RAID 10	•		•	
	RAID 5			•	
	RAID 1E	•		•	
	RAID 1			•	
* Decreases the existing redundancy					

Important

- The Target disk array may require more disk drives than the Source disk array.
- If the Target disk array requires an EVEN number of disk drives but the Source disk array has an ODD number, ADD a disk drive as part of the migration process.
- You cannot reduce the number of disk drives in your disk array, even if the Target disk array requires fewer disk drives than the Source disk array.
- RAID 1 (mirroring) works with two drives only. Only a single-drive RAID 0 disk array or a single-drive JBOD can migrate to RAID 1. Other RAID Levels use too many drives to migrate.
- You cannot migrate a disk array when it is Critical or performing activities such as Synchronizing, Rebuilding, and PDM.
- You cannot migrate to RAID 6 or RAID 60. You cannot migrate from RAID 60 to another RAID level. You must create a new disk array and move your data to it.

The Windows 2000 and Windows XP (32-bit) operating systems support a 10-byte LBA format. As a result, these OSes can only recognize 4 billion addresses. If you create a logical drive using the default 512 B sector size, the logical drive will be limited to 2 TB of data, even if there is more space available on your disk drives.

This limitation does not apply to Windows XP (64-bit), 2003 Server, Vista, and Linux OSes with the 2.6 kernel. Linux OSes with the 2.4 kernel do not support variable sector sizes, therefore you cannot apply the solution described here to those OSes.

Note that once you create your logical drive, you cannot change the size of the sectors. Nor can you increase the number of address blocks that the OS recognizes.

IMPORTANT!

Be aware that not all HBAs and their drivers are compatible with the OS to use the over 2TB functionality.

You can direct GAM to expand a logical drive beyond the maximum expansion size. When the expansion is finished:

- GAM will show the logical drive in the desired size.
- Your operating system might show the logical drive at the maximum size listed in the table below.
- Additional capacity might appear as unpartitioned and unformatted.

Current LD Size	Maximum LD Expansion Size	Sector Size
8 to 16 TB	16 TB	4096 bytes
4 to 8 TB	8 TB	2048 bytes
2 to 4 TB	4 TB	1024 bytes
up to 2 TB	2 TB	512 bytes

At this point, you have the choice of:

- Format the unpartitioned/unformatted capacity as a second logical drive
- Delete the existing disk array and create a new one in the desired size

Delete and Recreate

If you require a logical drive larger than the maximum expansion size:

1. Backup the data from the current logical drive.
2. Delete the current logical drive.
3. Create a new logical drive with the desired capacity.
4. Restore the data to the new logical drive.

7.12 Media Patrol

Media Patrol is a routine maintenance procedure that checks the magnetic media on each disk drive. Media Patrol checks all physical drives assigned to disk arrays. Media Patrol does not check unconfigured drives.

Media Patrol will also check spare drives, if those drives have Media Patrol enabled. Media Patrol for spare drives is enabled by default. You can disable it in Galaxy3G's Command Line Interface (CLI).

Unlike Synchronization and Redundancy Check, Media Patrol is concerned with the condition of the media itself, not the data recorded on the media. If Media Patrol encounters a critical error, it triggers PDM if PDM is enabled.

You can run Media Patrol from the subsystem. See "Running Media Patrol" . You can also run Media Patrol on a disk array. See "Running Media Patrol on a Disk Array".

7.13 Predictive Data Migration (PDM)

Predictive Data Migration (PDM) is the migration of data from the suspect disk drive to a spare disk drive, similar to Rebuilding a Logical Drive. But unlike Rebuilding, PDM constantly monitors your disk drives and automatically copies your data to a spare disk drive before the disk drive fails and your Logical Drive goes Critical. See “Running PDM”.

After the data is copied from the suspect disk drive, the controller marks it with a Stale configuration and a PFA error.

You can clear the Stale configuration and PFA error and put the disk drive back into service. See “Clearing Stale and PFA Conditions”. In some cases, however, you might remove the disk drive for repair or replacement.

PDM Triggers

The following actions trigger PDM:

- A disk drive with unhealthy status (see below)
- Media Patrol finds a disk critical error*
- You initiate PDM manually

*PDM also counts the number of media errors reported by Media Patrol.

A disk drive becomes unhealthy when:

- A SMART error is reported
- The bad sector remapping table fills to the specified level

Because data would be lost if written to a bad sector, when a bad sector is detected, the disk drive creates a map around it. These maps are saved in the bad sector remapping table, which has a capacity of 512 reassigned blocks and 1024 error blocks.

When the table fills to a specified percentage of its capacity, PDM triggers a migration of data from the suspect drive (the disk drive with the bad sectors) to a spare disk drive.

During data migration, you will have access to the Logical Drive but it will respond more slowly to read/write tasks because of the additional operation. The time required for data migration depends on the size of the disk drive.

See “Making Background Activity Settings”.

7.14 Transition

The Transition feature enables you to specify “permanent” spare drives for your Galaxy3G subsystem. Transition is the process of replacing a revertible spare drive that is currently part of a disk array with an unconfigured physical drive or a non-revertible spare. The revertible spare drive returns to its original status.

Transition happens automatically when the following sequence of events takes place:

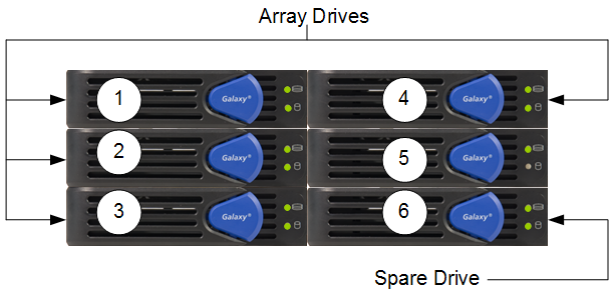
- You create a revertible spare drive.
- A physical drive assigned to your disk array fails and the array goes critical or degraded.
- Galaxy3G automatically rebuilds your array to the revertible spare drive and the array becomes functional again.
- You replace the failed physical drive with a new physical drive of equal or greater capacity.
- Galaxy3G automatically transitions (moves) the data from the revertible spare to the new physical drive.
- The new physical drive becomes part of the array and the revertible spare drive returns to its original spare status.

Transition happens manually when you specify a different unconfigured physical drive to transition (move) the data from the revertible spare drive.

See the example below.

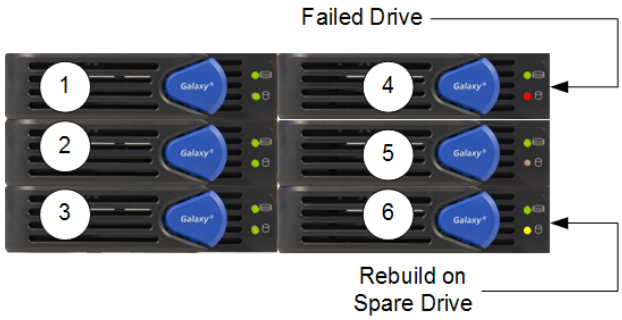
Example

Following is an example to explain the Transition function.



In the example above, there is a four-drive RAID 5 disk array and a global spare drive. Physical drives 1, 2, 3, and 4 belong to the disk array. Physical drive 5 remains unconfigured. Physical drive 6 is a revertible spare drive.

If a physical drive fails in a disk array and there is a spare drive of adequate capacity available, the controller automatically rebuilds the array using the spare drive. In this example, physical drive 4 failed and the array is rebuilt using physical drive 6, the revertible spare drive.



When the rebuild is complete, the spare drive has replaced the failed drive. In this example, failed drive 3 was replaced by spare drive 6. The disk array now consists of physical drives 1, 2, 4, and 6.

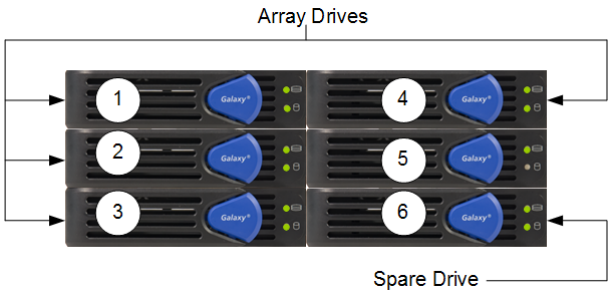
There is no spare drive at this moment. Even if physical drive 5 is of adequate capacity, it has not been designated as a spare, therefore the controller cannot use it as a spare.

Automatic Transition

At this juncture, you would replace the failed drive in slot 4 with a new one of the same or greater capacity.

When the Galaxy3G controller detects the new drive in slot 4, it will:

- Automatically transition the data on drive 6 to drive 4



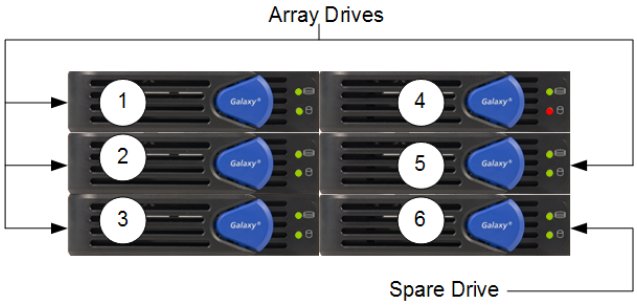
- Return drive 6 to spare status

When the Automatic Transition is finished, physical drives 1, 2, 3, and 4 belong to the disk array and physical drive 6 is a revertible spare drive. The original configuration is restored.

Manual Transition

If you wanted to use the drive in slot 5 as a member of the disk array, rather than the drive in slot 4, you would run the Transition function manually.

When the Manual Transition is finished, physical drives 1, 2, 3, and 5 belong to the disk array and physical drive 6 is a revertible spare drive.



At this point, you would replace the drive in slot 4. The new drive in slot 4 will be unconfigured until you assign it to a disk array or as a spare.

Section 8
Troubleshooting

8.0 Troubleshooting

This chapter covers the following topics:

- 8.1 Galaxy3G is Beeping
- 8.2 LEDs Display Amber or Red
- 8.3 CLU Reports a Problem
- 8.4 GAM Reports a Problem
- 8.5 Event Notification Response
- 8.6 Critical & Offline Disk Arrays
- 8.7 Incomplete Array
- 8.8 Physical Drive Problems
- 8.9 Enclosure Problems
- 8.10 Controller Enters Maintenance Mode
- 8.11 Connection Problems
- 8.12 Browser Does Not Connect to Galaxy Array Manager
- 8.13 Unsaved Data in the Controller Cache

8.1 Galaxy3G is Beeping

Galaxy3G's alarm has five different patterns, as shown below.

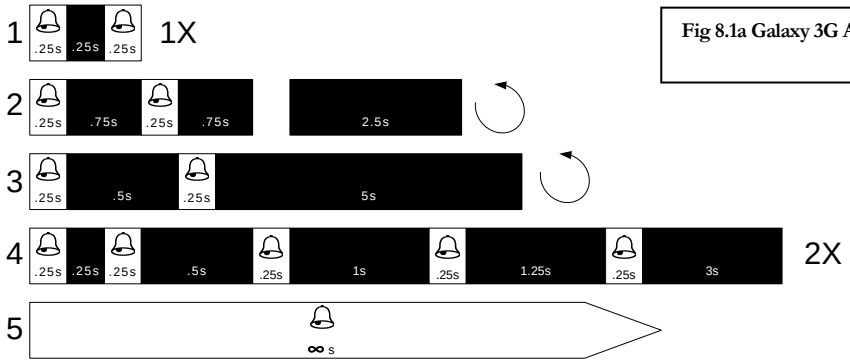


Fig 8.1a Galaxy 3G Alarm patterns

When you first power-up the Galaxy3G, it beeps twice to show normal operation.

The audible alarm sounds at other times to inform you that the Galaxy3G needs attention. But the alarm does not specify the condition. When the alarm sounds:

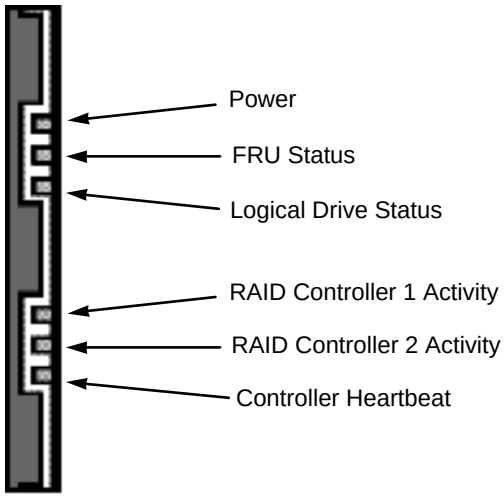
- Check the front and back of Galaxy3G for red or amber LEDs, as described above.
- If email notification is enabled, check for new messages.
- Check for yellow !s ! red Xs ✕ in Tree View.
- Check the event log. See GAM.

When a continuous tone sounds, there are multiple alarm patterns sounding at the same time.

8.2 LEDs Display Amber or Red

Front Panel

Fig 8.2aa Galaxy 3G front panel LED display



When the power is switched on, the LEDs on the front of the Galaxy3G will light up.

When boot-up is finished and the Galaxy3G is functioning normally:

- Controller Heartbeat LED blinks once every two seconds.
- Power, FRU and Logical Drive LEDs display green continuously.
- The RAID Controller LEDs flash green if there is activity on that controller.

LEDs	State				
	Dark	**Steady Green**	**Flashing Green**	**Amber**	**Red**
Power	System Off	Normal			
FRU*	System Off	Normal		Fan, battery or PSU Problem	Fan, battery or PSU Failed
Logical Drive	System Off	Normal		Logical Drive Critical	Logical Drive Offline
Controller Activity	No Activity		Activity		
Controller Heartbeat	System Off		Normal**		

* Field Replacement Unit: includes fan, battery, and power supply unit (PSU).

** Blinks once every two seconds.

Drive Status Indicators

There are two LEDs on each Drive Carrier. They report the presence of power and a disk drive, and the current condition of the drive.

The Galaxy3G spins up the disk drives sequentially in order to equalize power draw during start-up. After a few moments the Power/Activity and Disk Status LEDs should display green.

Fig 8.2b Galaxy 3G drive carrier LEDs

LEDs	State				
	Dark	Steady Green	Flashing Green	Amber	Red
Power/Activity	No Drive	Drive Present	Activity		
Status	No Power/No Drive	Drive OK		Drive Rebuilding	Drive Error

See

8.6 Critical & Offline Disk Array for a discussion of rebuilding and failed disk drives.

Back of Enclosure

When the FRU Status LED on Galaxy3G's front panel shows Amber or Red, check the LEDs on the back of Galaxy3G. These LEDs give the status of the field replaceable units.

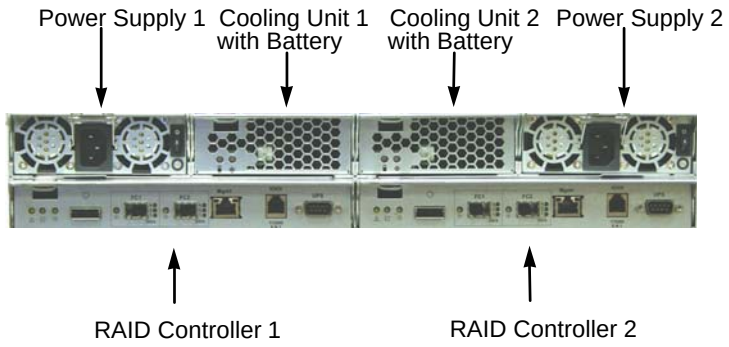


Fig 8.2c Galaxy 3G 12 bay rear view

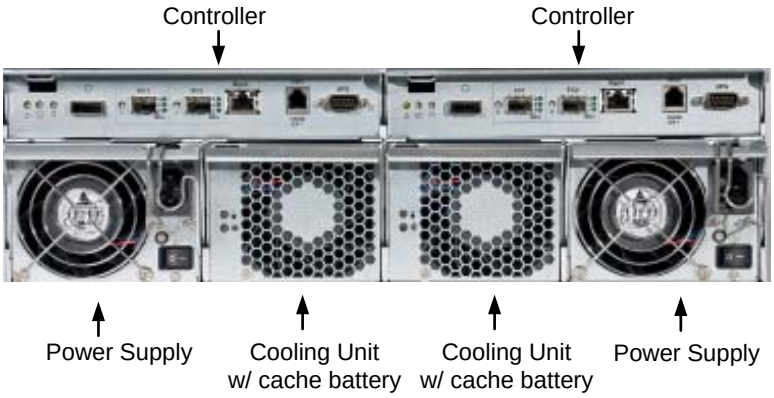


Fig 8.2d Galaxy 3G 16 bay rear view

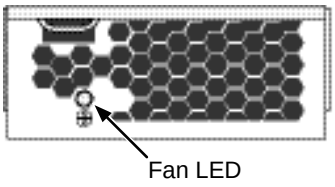


Fig 8.2e Galaxy 3G FAN LED on cooling unit

Under normal conditions, the power supply and fan LEDs should display green.

LEDs	State			
	Dark	Green	Amber	Red
Power supply	Not detected	OK	Fan failed	Failed
Fan	Not detected	OK	Wrong speed	Failed

To check a component's installation, follow the same procedure as replacing the component, except that you reinstall the original component rather than a new one. In most cases, this action fixes a bad connection and allows Galaxy3G to detect the component. If this action does not correct the problem, replace the unit.

The Controller Location LEDs, on the back of the Galaxy3G subsystem, will flash for one minute.

Fig 8.2f Galaxy 3G FC4 Controller LEDs

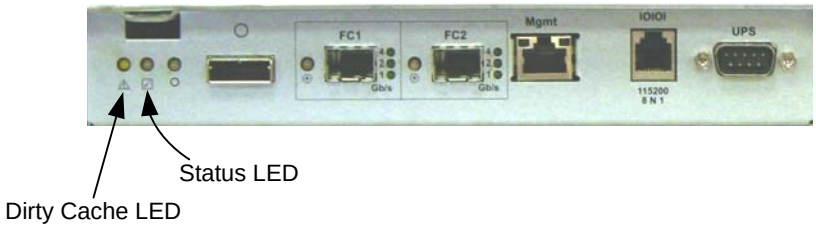


Fig 8.2g Galaxy 3G S3 Controller LEDs

Under normal conditions, the Controller Status LED (marked with ✓ icon) is green and the Dirty Cache LED (marked with L icon) is dark. See the table below.

LEDs	State			
	Dark	Green	Amber	Flashing Amber
Status ✓	no power	OK	Error	
Dirty Cache L	OK		Unsaved data in cache	OK

If the Controller Status LED is amber, restart the Galaxy3G. See “Restarting the Subsystem”.

If the Controller Status LED continues to display amber after startup, contact Technical Support. See “Contacting Technical Support”.

The Dirty Cache LED flashes during input/output operation. If the LED shines amber and the power is off, there is unsaved data in the cache. Do NOT power down the Galaxy3G while this LED is on.

8.3 CLU Reports a Problem

The CLU reports information passively—you must determine which functions to check based on the sound of the Galaxy3G's audible alarm (see 8.1 Galaxy3G is Beeping) and any amber or red LEDs (see

8.2 LEDs Display Amber or Red).

Check the event logs first. Then check the reported component.

Viewing Runtime Events

To display Runtime Events:

1. From the Main Menu, highlight Event Viewer and press Enter.

   The log of Runtime Events appears. Events are added to the top of the list. Each item includes:

   - Sequence number – Begins with 0 at system startup.
   - Device – Disk Array, Logical Drive, Physical Drive by its ID number.
   - Severity – (lowest to highest) Information, Warning, Minor, Major, Critical and Fatal
   - Timestamp – Date and time the event happened.
   - Description – A description of the event in plain language.

Press the up and down arrow keys to scroll through the log.

Viewing NVRAM Events

This screen displays a list of and information about 63 most important events over multiple subsystem startups.

To display NVRAM events:

1. From the Main Menu, highlight Event Viewer and press Enter.
2. Highlight NVRAM Events and press Enter.

   The log of NVRAM Events appears. Events are added to the top of the list. Each item includes:

   - Sequence number – Begins with 0 at system startup.
   - Device – Disk Array, Logical Drive, Physical Drive by its ID number.
   - Severity – (lowest to highest) Information, Warning, Minor, Major, Critical and Fatal
   - Timestamp – Date and time the event happened.
   - Description – A description of the event in plain language.
3. Press the up and down arrow keys to scroll through the log.

Checking a Reported Component

In this example, let us check disk array status.

1. Open the CLU.
2. Highlight Disk Array Management and press Enter.
3. Observe the status of your disk arrays.

DaId	Alias	OpStatus	CfgCapacity	FreeCapacity	MaxContiguousCap
0	DA0	OK	75.44GB	66.06GB	66.06GB
1	DA1	Degraded	189.06GB	179.68GB	179.68GB
2	DA2	OK	73.57GB	64.20GB	64.20GB

At this point, you can highlight the Degraded array and press Enter to see more information. See below.

```
Disk Array ID          : 1              Physical Capacity        : 189.06GB
OperationalStatus      : Degraded       MaxContiguousCapacity    : 11.18GB
FreeCapacity           : 179.68 GB      ConfigurableCapacity     : 179.68GB
SupportedRAIDLevels:  0 5 10 1E

Disk Array Alias       : DA1
MediaPatrol            : Enabled
PDM                    : Enabled

Transport
Rebuild
Predictive Data Migration
Transition
Dedicated Spare Drives in the Array
Physical Drives in the Array
Logical Drives in the Array
[Locate Disk Array]

Save Settings          [CTRL-A]
Restore Settings       [CTRL-R]
Return to Previous Menu
```

From this screen:

- Highlight Physical Drives in the Array and press Enter to identify the failed disk drive
- Highlight Rebuild and press Enter to rebuild the array after you replace the failed disk drive

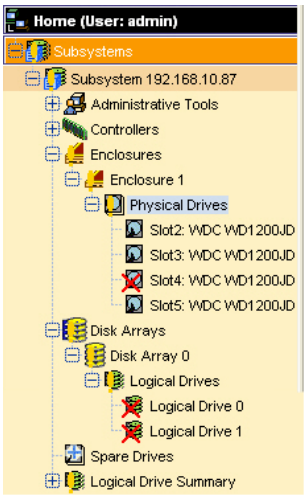
For more information, see Critical & Offline Disk Array.

8.4 GAM Reports a Problem

GAM aids in troubleshooting your logical drives and enclosure by continuous monitoring and reporting to the User in the following ways:

- Displays yellow exclamation points ! and red Xs ✕ in Tree View.

Fig 8.4a GAM tree view shows yellow ! and red X for areas that need attention



- Sends email messages, per your configuration.
- Displays popup messages, per your configuration.

To set up email and popup message notification, see “Setting-up User Event Subscriptions”

Fig 8.4b Example of GAM pop up message

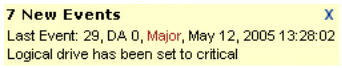
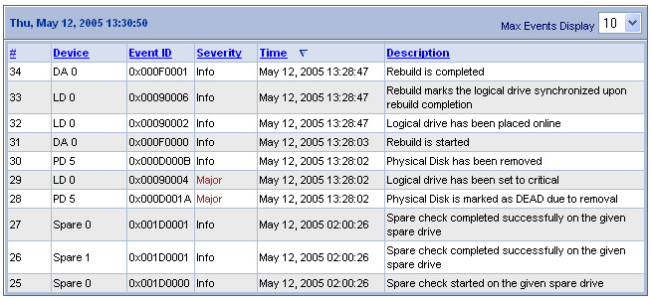


Fig 8.4c Example of GAM Event log



#	Device	Event ID	Severity	Time	Description
34	DA 0	0x000F0001	Info	May 12, 2005 13:28:47	Rebuild is completed
33	LD 0	0x00090006	Info	May 12, 2005 13:28:47	Rebuild marks the logical drive synchronized upon rebuild completion
32	LD 0	0x00090002	Info	May 12, 2005 13:28:47	Logical drive has been placed online
31	DA 0	0x000F0000	Info	May 12, 2005 13:28:03	Rebuild is started
30	PD 5	0x000D000B	Info	May 12, 2005 13:28:02	Physical Disk has been removed
29	LD 0	0x00090004	Major	May 12, 2005 13:28:02	Logical drive has been set to critical
28	PD 5	0x000D001A	Major	May 12, 2005 13:28:02	Physical Disk is marked as DEAD due to removal
27	Spare 0	0x001D0001	Info	May 12, 2005 02:00:26	Spare check completed successfully on the given spare drive
26	Spare 1	0x001D0001	Info	May 12, 2005 02:00:26	Spare check completed successfully on the given spare drive
25	Spare 0	0x001D0000	Info	May 12, 2005 02:00:26	Spare check started on the given spare drive

- Keeps a record in the Event Log.
- Displays full information in Management View.

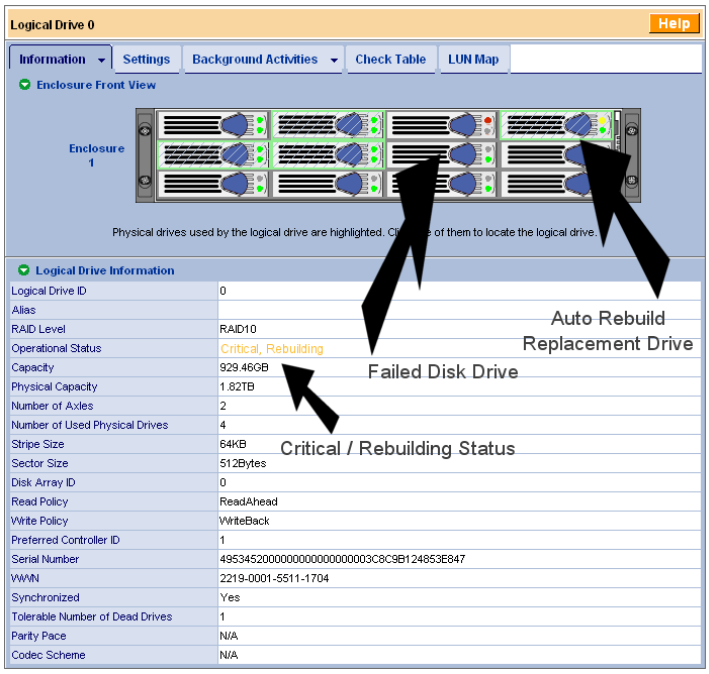


Fig 8.4d Example of RAID rebuild in GAM

8.5 Event Notification Response

When you select Event Notification, the Galaxy Array Manager sends popup and/or email messages regarding its status. The messages you see depend on your notification selection and what is currently happening in the Galaxy3G. See “Setting-up User Event Subscriptions”.

The table below cites:

- Reported Events – Events that require you to take action
- Corrective Actions – The action you should take in response to the event

A list of event categories is shown below.

- **Battery**
- **Blowers**
- **Cache**
- **Controller**
- **Disk Array**
- **Drive Interface Controller**
- **Enclosure**
- **Event Log**
- **Fibre Channel**
- **Host Interface Controller**
- **Logical Drive**
- **Media Patrol**
- **Online Capacity Expansion**
- **PDM**
- **Physical Disk**
- **PSU (Power Supply Units)**
- **PSU Fans**
- **RAID Level Migration**
- **Rebuild**
- **Redundancy Check**
- **Resource**
- **Spare Check**
- **Spare Drives**
- **SMART**
- **Stripe Level Migration**
- **Synchronization**
- **System (Galaxy3G)**
- **Transition**
- **Watermark**

Reported Event	Corrective Action
Battery	
Battery temperature is above the threshold	The battery is too hot. Verify proper airflow around the through the Galaxy3G. If airflow is OK, replace the battery.
Battery temperature is normal	Normal.
Battery capacity is below the threshold	Battery is drained. Run battery reconditioning.
Battery capacity is normal	Normal.
Battery is discharging	Battery is undergoing reconditioning.
Battery is charging	Battery is being recharged.

Battery reconditioning is complete	Battery reconditioning is finished.
Battery is malfunctioning	Run battery reconditioning. If this message reappears, replace the battery.
Battery reconditioned successfully	Battery reconditioning is finished.
Battery reconditioning has failed	Replace the battery.
Battery is reaching end of life	Replace the battery.
Battery is removed	The battery was disconnected or removed. Reinstall the battery.
Battery charging failed	Replace the battery.
Battery reconditioning started	Battery reconditioning has begun.
Battery recondition terminated	The battery was disconnected or removed during reconditioning. Reinstall the battery.
Blowers	
Blowers have started	Normal.
Blowers have stopped	Verify that the cooling unit is properly installed. If the blower still does not turn, replace the blowers.
Blower speed is increased	Check the Galaxy3G for overheating. See 8.9 Enclosure Problems.
Blower speed is decreased	Temporary overheat condition was corrected.
Blowers are NOT functioning	Replace the blowers.
Blowers have been inserted	Normal.
Blowers have been removed	Reinstall the cooling unit(s). If the blower does not turn, replace the blowers.
Blowers are functioning normally	Normal.
Blowers are NOT installed	Reinstall the cooling unit(s). If the blower does not turn, replace the blowers.

Blower status is unknown	Check for airflow out of the cooling unit. If there is none, check for proper installation.
Cache	
BBU flushing has started	Galaxy3G's cache is being flushed.
BBU flushing has ended	Galaxy3G's cache has been flushed.
BBU flushing has failed	Galaxy3G's cache could not be flushed. Check your cache flush interval setting..
Controller	
The controller parameter(s) changed by user	The user successfully changes controller settings.
The controller has new crash information	Check the event logs.
Controller temperature is above the threshold/warning threshold	The Galaxy3G controller is overheating. Check for airflow around and through the controller, and verify that all fans are working. Replace fans as needed.
Controller temperature is above the critical threshold	The Galaxy3G controller is seriously overheating. Check for airflow around and through the controller, and verify that all fans are working. Replace fans as needed.
Disk Array	
New disk array has been created	Result of settings or user action. Normal.
Disk array has been deleted	Result of settings or user action. Normal.
Disk array has been added	Result of settings or user action. Normal.
Disk array has been removed	The physical drives of the disk array were removed from the enclosure.
Disk array settings have been changed	The user successfully logical drive settings.
Drive Interface Controller	
Drive-interface controller found	Normal.
Drive-interface controller is NOT found	Restart the Galaxy3G. If this message appears repeatedly, contact Technical Support.

Drive-interface diagnostics has passed	Normal.
Drive-interface diagnostics has failed	Restart the Galaxy3G. If this message appears repeatedly, contact Technical Support.
Drive-interface controller has generated a general/data parity error.	Drive-to-controller parity error. If this message appears repeatedly, contact Technical Support.
Enclosure	
Enclosure temperature is above the threshold/warning threshold	The Galaxy3G is overheating. Check for airflow around and through the Galaxy3G, and verify that all fans are working. Replace fans as needed.
Enclosure temperature is above the critical threshold	The Galaxy3G is seriously overheating. Check for airflow around and through the Galaxy3G, and verify that all fans are working. Replace fans as needed.
Enclosure temperature is within the normal range	Normal.
Event Log	
Event logging is enabled	Event logging has been successfully enabled.
Event logging is disabled	Event logging has been disabled.
Event log buffer is cleared in RAM	The event log was cleared.
Event log buffer is cleared in NVRAM	The non-volatile RAM event log was cleared.
Event log buffer is cleared in MDD	The MDD (disk drive) event log was cleared.
Fibre Channel	
Fibre Channel controller has detected bus reset	The initiator sent a reset command. If this message appears repeatedly, contact Technical Support.
Fibre Channel controller has received a LUN reset command.	Result of user action. Normal.
Fibre Channel controller has encountered a fatal error	Restart the Galaxy3G. If this message appears repeatedly, contact Technical Support.
Fibre Channel link is up	FC link connected and ready. Normal.
Fibre Channel link is down	FC link disconnected or otherwise not working.

Fibre Channel controller settings have changed	Result of user action. Normal.
Host Interface Controller	
Host-interface controller has detected bus reset	The initiator sent a reset command. If this message appears repeatedly, contact Technical Support.
Host-interface controller has encountered an unrecoverable error	Restart the Galaxy3G.
Host-interface controller has received an abort-task/ abort task set/clear task set command.	Result of user action. Normal.
Host-interface controller has received a clear ACA command.	Result of clearing an auto contingent alliance condition. If this message appears repeatedly, contact Technical Support.
Host-interface controller has received a LUN reset command.	Result of user action. Normal.
Host-interface controller has received a bus reboot	The Galaxy3G rebooted itself. If this message appears repeatedly, contact Technical Support.
Host-interface controller has encountered an unknown error	An unidentified error occurred. If this message appears repeatedly, contact Technical Support.
Host-interface controller has encountered a system error	A Galaxy3G system error occurred. If this message appears repeatedly, contact Technical Support.
Host-interface controller has encountered a fatal error	Restart the Galaxy3G. If this message appears repeatedly, contact Technical Support.
Host-interface controller settings have changed	Result of user action. Normal.
Logical Drive	
Logical drive initialization has started	Result of user action. Normal.
Logical drive initialization has completed	Logical drive is ready to use. Normal.
Logical drive initialization has paused	Initialization paused because of user intervention, schedule or a higher priority background activity.

Logical drive initialization has resumed	Initialization has resumed again after a pause.
Logical drive initialization has stopped	Initialization stopped because of user intervention, schedule or the logical drive was deleted or went critical or offline.
Logical drive initialization marks the logical drive offline	Initialization failure due to a failed disk drive. Replace the disk drive, delete and recreate the logical drive.
Logical drive initialization is aborted due to an internal error.	System resources are low. Reduce system load or restart the Galaxy3G.
Logical drive initialization is queued	Initialization has been set manually or by schedule.
A new logical drive has been created	Result of user action. Normal.
Logical drive has been deleted	Result of user action. Normal.
Logical drive has been placed online	The physical drives of the array are restored to online status.
Logical drive has been placed online. Possible data loss	One or more physical drives in the array went offline..
Logical drive has been set to critical.	One or more physical drives in the array went offline. .
Logical drive axle has been placed online	RAID 50. One of the axles (RAID 5 arrays) returned on online status.
Media Patrol	
Media patrol is started	Result of settings or user action. Normal.
Media patrol is completed	Normal.
Media patrol is paused	Media patrol paused because of user intervention, schedule or a higher priority background activity.
Media patrol is resumed	Media patrol has resumed again after a pause.
Media patrol is stopped	Media patrol stopped because of user intervention, schedule or the logical drive was deleted or went critical or offline.
Media patrol is aborted due to an internal error.	System resources are low. Reduce system load or restart the Galaxy3G.
Media patrol is queued	Media patrol has been set manually or by schedule.

Media patrol is stopped internally	Media patrol stopped because the disk array was deleted or removed.
Online Capacity Expansion	
Online capacity expansion has started	Result of settings or user action. Normal.
Online capacity expansion has completed	Normal.
Online capacity expansion has paused	Expansion paused because of user intervention, schedule or higher priority background activity.
Online capacity expansion has resumed	Expansion has resumed again after a pause or a reboot.
Online capacity expansion has stopped	Expansion stopped because of user intervention, schedule or the logical drive was deleted or went critical or offline.
Online capacity expansion has encountered a physical disk error	Bad block found on a disk drive. Migration will finish. Check the disk drive check table after migration and replace disk drive as needed.
Online capacity expansion is aborted due to an internal error.	System resources are low. Reduce system load or restart the Galaxy3G.
Online capacity expansion is queued	Synchronization has been set manually or by schedule.
PDM	
PDM is started	Result of settings or user action. Normal.
PDM is completed	Normal.
PDM is paused	PDM paused because of user intervention, schedule or a higher priority background activity.
PDM is resumed	PDM has resumed again after a pause.
PDM is stopped	PDM stopped because of user intervention, schedule or the logical drive was deleted or went critical or offline.
PDM is switched to rebuild.	PDM changed to rebuild because the logical drive went critical
PDM is stopped internally	The destination drive was removed or used for a rebuild.
Physical Disk	

Physical disk is marked online	Disk drive restored to normal operation.
Physical disk is marked online	Disk drive removed from service due to errors. If necessary, try to force the disk online.
Physical disk is marked as dead.	Disk drive failure. Replace the disk drive.
Physical disk has been reset	Disk drive reset after error and should function normally.
Physical disk assigned as global spare	Result of settings or user action. Normal.
Physical disk is no longer assigned as global spare	Result of settings or user action. Normal.
Physical disk assigned as dedicated spare	Result of settings or user action. Normal.
Physical disk is no longer assigned as dedicated spare	Result of settings or user action. Normal.
Physical disk has been inserted	A disk drive has been inserted into the Galaxy3G subsystem.
Physical disk has been removed	A disk drive has been removed from the Galaxy3G subsystem.
Bad sector is found on physical disk	Disk drive has a bad sector. The drive should remap around the bad sector. If this message appears repeatedly, replace the disk drive.
Error is detected in remap sectors	Disk drive has a bad remap sectors. If this message appears repeatedly, replace the disk drive.
Command times out on physical drive	Disk drive not responding to commands. If this message appears repeatedly, replace the disk drive.
Physical disk negotiation speed is decreased.	Disk drive had to reduce its data rate. If this message appears repeatedly, replace the disk drive.
Previously configured disk is no longer found	Disk drive may have failed or was removed from the enclosure. Replace or reinstall the disk drive as needed.
A physical disk has encountered an unknown (non-ECC) media error.	Disk drive experienced an unknown error. If this message appears repeatedly, replace the disk drive.
A physical disk has encountered PFA condition	A potentially faulty address or bad sector was found.

A configured dead physical drive has been inserted	The disk drive inserted into the Galaxy3G was marked as dead and will not work on the Galaxy3G. Replace the disk drive.
A physical drive page 0/1 settings have been changed	Result of settings or user action. Normal.
Physical disk is marked as dead due to removal/failure of reassign sectors/PFA condition/forced offline state	Replace the disk drive.
PSU (Power Supply Units)	
PSU is not inserted/has been removed	A power supply unit is missing from the Galaxy3G. Reinstall the power supply unit.
PSU is off	A power supply unit is present but turned off. Turn on the power supply.
PSU is on	Normal.
PSU is installed/operational and turned on	Normal.
PSU is installed/operational and turned off	A power supply unit is present but turned off. Turn on the power supply.
PSU is malfunctioning and turned on/off	Replace the power supply unit.
PSU 12V/5V/3.3V power is out of the threshold range	Replace the power supply unit.
PSU 12V/5V/3.3V power is within the range	Normal.
PSU Fans	
PSU fan has turned on.	Normal.
PSU fan has turned off.	Verify that the power supply is turned on. If the fan still does not turn, replace the power supply.
PSU fan speed increased.	Check the Galaxy3G for overheating. See 8.9 Enclosure Problems.
PSU fan speed decreased.	Temporary overheat condition was corrected.

PSU fan is malfunctioning	Replace the power supply.
PSU fan is functioning normally	Normal.
PSU fan status is unknown.	Check for airflow out of the power supply. If there is none, check for proper installation and turn the power supply on.
RAID Level Migration	
RAID Level migration is started	Result of settings or user action. Normal.
RAID Level migration is completed	Normal.
RAID Level migration is paused	Migration paused because of user intervention, schedule or a higher priority background activity.
RAID Level migration is resumed	Migration has resumed again after a pause.
RAID Level migration is stopped	Migration stopped because of user intervention, schedule or the logical drive was deleted or went critical or offline.
RAID Level migration has encountered a physical disk error	Bad block found on a disk drive. Migration will finish. Check the disk drive check table after migration and replace disk drive as needed.
RAID Level migration is aborted due to an internal error.	System resources are low. Reduce system load or restart the Galaxy3G.
RAID Level migration is queued	Migration has been set manually or by schedule.
Migration has detected/cleared stale NV Watermark	Watermarks are progress markers left as the result of interrupted RAID migrations. If the watermark was cleared, migration should finish.
Array was incomplete due to missing NV Watermark	RAID migration was interrupted by a shutdown. If array is online, try migration again. If array is offline, delete and recreate array.
Rebuild	
Rebuild is started	Result of settings or user action. Normal.
Rebuild is completed	Normal.
Rebuild is paused	Rebuild paused because of user intervention, schedule or a higher priority background activity.
Rebuild is resumed	Rebuild has resumed again after a pause.

Rebuild is stopped	Rebuild stopped because of user intervention, schedule or the logical drive was deleted or the target disk drive encountered an error. If rebuild stopped by user intervention, restart the rebuild.
Rebuild stopped internally	The logical drive is offline.
Rebuild is aborted due to an internal error.	System resources are low. Reduce system load or restart the Galaxy3G.
Rebuild is queued	Rebuild has been set manually or by schedule.
Rebuild marks logical drive synchronized upon rebuild completion	Result of successful rebuild. Normal.
Redundancy Check	
Redundancy Check is started	Redundancy Check has started manually or by schedule.
Redundancy Check is completed	Redundancy Check has finished.
Redundancy Check is paused	Redundancy Check paused because of user intervention, schedule or a higher priority background activity.
Redundancy Check is resumed	Redundancy Check has resumed again after a pause.
Redundancy Check is stopped	Redundancy Check stopped because of user intervention, schedule or the logical drive was deleted or went critical or offline.
Redundancy Check is aborted due to internal error	System resources are low. Reduce system load or restart the Galaxy3G.
Redundancy Check encountered inconsistent block(s)	Check the logical drive's inconsistent block table. Rebuild the disk array if necessary.
Redundancy Check task is queued	Redundancy Check has been set manually or by schedule.
Redundancy Check task is stopped internally	The logical drive is offline..
Resource	
Resource is NOT available	System resources are low. Reduce system load or restart the Galaxy3G.

Spare Check	
Spare check started on the given spare drive	Result of settings or user action. Normal.
Spare check completed successfully on the given spare drive	Normal.
Spare Drives	
Physical disk assigned as global spare	Result of settings or user action. Normal.
Physical disk is no longer assigned as global spare	Result of settings or user action. Normal.
Global Spare has been deleted	Result of settings or user action. Normal.
Physical disk assigned as dedicated spare	Result of settings or user action. Normal.
Physical disk is no longer assigned as dedicated spare	Result of settings or user action. Normal.
Dedicated Spare has been deleted	Result of settings or user action. Normal.
SMART	
SMART error is received	A disk drive reported a SMART error. If this message appears repeatedly, replace the disk drive.
Stripe Level Migration	
Stripe Level migration is started	Result of settings or user action. Normal.
Stripe Level migration is completed	Normal.
Stripe Level migration is paused	Migration paused because of user intervention, schedule or a higher priority background activity.
Stripe Level migration is resumed	Migration has resumed again after a pause.
Stripe Level migration is stopped	Migration stopped because of user intervention, schedule or the logical drive was deleted or went critical or offline.

Stripe Level migration has encountered a physical disk error	Bad block found on a disk drive. Migration will finish. Check the disk drive check table after migration and replace disk drive as needed.
Stripe Level migration is aborted due to an internal error.	System resources are low. Reduce system load or restart the Galaxy3G.
Stripe Level migration is queued	Migration has been set manually or by schedule.
Synchronization	
Synchronization is started	Result of settings or user action. Normal.
Synchronization is completed	Normal.
Synchronization is paused	Synchronization paused because of user intervention, schedule or higher priority background activity.
Synchronization is resumed	Synchronization has resumed again after a pause or a reboot.
Synchronization is stopped	Synchronization stopped because of user intervention, schedule or the logical drive was deleted or went critical or offline.
Synchronization is aborted due to an internal error.	System resources are low. Reduce system load or restart the Galaxy3G.
Synchronization is queued	Synchronization is already running on another logical drive in the same array.
Synchronization is stopped internally	Synchronization stopped because the disk array was deleted or removed.
System (Galaxy3G)	
The system is started	The Galaxy3G has been started.
The system is stopped	The Galaxy3G was shut down.
Transition	
Transition is started	Result of settings or user action. Normal.
Transition is completed	Normal.
Transition is paused	Transition paused because of user intervention, schedule or a higher priority background activity.
Transition is resumed	Transition has resumed again after a pause.

Transition is stopped	Transition stopped because of user intervention or the logical drive was deleted.
Transition was switched to rebuild	Transition changed to rebuild because the logical drive went critical.
Watermark	
Migration has detected/cleared stale NV Watermark	Watermarks are progress markers left as the result of interrupted RAID migrations. If the watermark was cleared, migration should finish.
Array was incomplete due to missing NV Watermark	RAID migration was interrupted by a shutdown. If array is online, try migration again. If array is offline, delete and recreate array.

8.6 Critical & Offline Disk Arrays

A fault-tolerant disk array—RAID 1, 1E, 5, 10, and 50—goes `critical` when a disk drive is removed or fails.

A RAID 6 or 60 disk array—goes `degraded` when a disk drive is removed or fails and `critical` when two disk drives are removed of fail.

Due to the fault tolerance of the disk array, the data is still available and online. However, once the disk array goes critical, the disk array has lost its fault tolerance, and performance may be adversely affected.

If the fault was caused by a failed drive that was removed, the drive must be replaced by another drive, either identical or larger, in order for the RAID system to rebuild and restore optimal configuration.

If your fault-tolerant disk array—RAID 1, 1E, 5, 6, 10, 50, and 60— goes `offline`, contact Technical Support.

Warning

Take no further corrective action until you have consulted with Galaxy Technical Support.

A non-fault tolerant disk array—RAID 0—goes `offline` when a disk drive is removed or fails. Since the disk array is not fault tolerant, the data stored in the disk array is no longer accessible.

If one disk drive fails, all of the data on the disk array is lost. You must replace the failed drive. Then, if the disk array had more than one disk drive, delete the disk array and re-create it. Restore the data from a backup source.

When a Physical Drive Fails

Galaxy3G provides both audible and visual indicators to alert you of a disk drive failure. The following will occur when a disk drive fails or goes offline:

- The Logical Drive LED changes from green to amber. See

8.2 LEDs Display Amber or Red.

- The Disk Carrier Status LED changes from green to red. See Drive Status Indicators.
- The audible alarm repeatedly sounds two short beeps. See 8.1 Galaxy3G is Beeping.
- GAM reports the condition. See GAM Reports a Problem . Also see Physical Drive Problems

With a Hot Spare Drive

When a physical drive in a disk array fails and a spare drive of adequate capacity is available, the disk array will begin to rebuild automatically using the spare drive.

After the disk array rebuilds itself using the spare drive, you must replace the failed drive.

To set up a spare drive, see “Creating a Spare Drive”

Without a Hot Spare Drive

If there is no hot spare drive of adequate capacity, you must remove the failed drive and install an unconfigured replacement drive of the same or greater capacity in the same slot as the failed drive. Until you install the replacement drive, the logical drive will remain Degraded.

- If the Auto Rebuild function is ENABLED, the disk array will begin to rebuild automatically as soon as you replace the failed drive.
- If the Auto Rebuild function is DISABLED, you must manually rebuild the disk array after you replace the failed drive.

To enable Automatic Rebuild, see “Making Background Activity Settings” . To set Hot Spare Policy, see “Making Spare Drive Settings”.

Important

If your replacement disk drive was formerly part of a different disk array or logical drive, you must clear the configuration data on the replacement drive before you use it.
See “Clearing Stale and PFA Conditions”

Rebuild Operation

During rebuild:

- The alarm sounds a single short beep, repeated
- No warning icon displays over the Disk Array or Logical Drive in the Tree.
  Management View reports the Disk Array’s Operational Status as OK, Rebuilding.
- The drive carrier holding the rebuilding physical drive displays a green Activity (lower) LED while the Status (upper) LED flashes green once per second.

Fig 8.6a Galaxy 3G drive carrier LEDs

During rebuilding, you can still read and write data to the logical drive. However, fault tolerance is lost until the Disk Array returns to OK (not-rebuilding) status.

After a successful rebuild:

- The alarm is silent
- The Disk Array's Operational Status as OK
- The rebuilt disk drive Status LED displays steady green

8.7 Incomplete Array

An incomplete array results from a physical drive that fails or becomes missing during:

- RAID level migration under NVRAM
- Physical drive transport

See Physical Drive Failed for more information.

When Galaxy3G discovers an incomplete array, the Galaxy Array Manager displays a dialog box asking you to:

- Click the **OK** button to accept the incomplete array
- Click the **Cancel** button to reject the incomplete array

Before you accept the incomplete array, be sure all of the physical drives are present and that their drive carriers are properly installed into the enclosure. See “Installing Disk Drives” in chapter 2.

If you choose to accept the incomplete array:

1. Click **OK** in the incomplete array dialog box.
2. Check the operational status of the logical drives in the array.
   - If the logical drives are `critical` or `degraded`, proceed with a rebuild. See “Rebuilding a Disk Array”.
   - If the logical drives are `offline`, contact Technical Support.
3. Restore your data from a backup source, if required.

The CLU displays the option `Accept Incomplete Array` on the Disk Array Info and Settings screen. Highlight the option and press Enter to accept the incomplete array.

If you choose NOT to accept the incomplete array:

1. Click **Cancel** in the incomplete array dialog box.
2. Do one of the following:
   - Delete the array. See “Deleting a Disk Array”
   - Replace the missing physical drive.

8.8 Physical Drive Problems

Physical Drive Offline

Check the drive for:

- PFA Condition – Caused by a bad block or sector.
  See “Clearing Stale and PFA Conditions”
- Stale Configuration – Caused by obsolete array information on the physical drive. Identify the disk array to which the physical drive belongs. Then delete the disk array. See “Deleting a Disk Array”
- If the error condition remains on the physical drive, clear the error condition. See “Clearing Stale and PFA Conditions”

Physical Drive Not Usable

This condition occurs when you have:

- Two controllers in your Galaxy3G subsystem and a SATA drive without an AAMUX adapter. See “AAMUX Adapter” in chapter 2.
- A missing or defective SAS cable between the Galaxy3G subsystem and a JBOD enclosure.

Physical Drive Failed

When physical drive status shows `failed`, the physical drive cannot be repaired. You must replace the failed drive.

Physical Drive Fails during Migration

Galaxy3G has two methods for migrating a disk array:

- DDF – The default setting. Slower but reliable
- NVRAM – An optional setting that requires special access. Faster but risks data loss

Normally, RAID level migration is done under the default Disk Data Format (DDF) setting. If a physical drive or the controller fails during migration, the disk array goes critical, and you can rebuild it. Migration under DDF can take up to several hours depending on the number and size of the physical drives and data input/output activity.

You can set the Galaxy3G to migrate disk arrays under Non-Volatile Random Access Memory (NVRAM), a much faster process because it writes data to the memory in the controller. However, if a physical drive or the controller fails during migration, the logical drives will go offline and you will lose data. See

Because the setting for migration under NVRAM requires special access, most users will not encounter this condition.

Physical Drive Fails during Transport

Transport is the action of moving the physical drives of a disk array:

- To different slots in the same Galaxy3G enclosure
- From one Galaxy3G enclosure to another

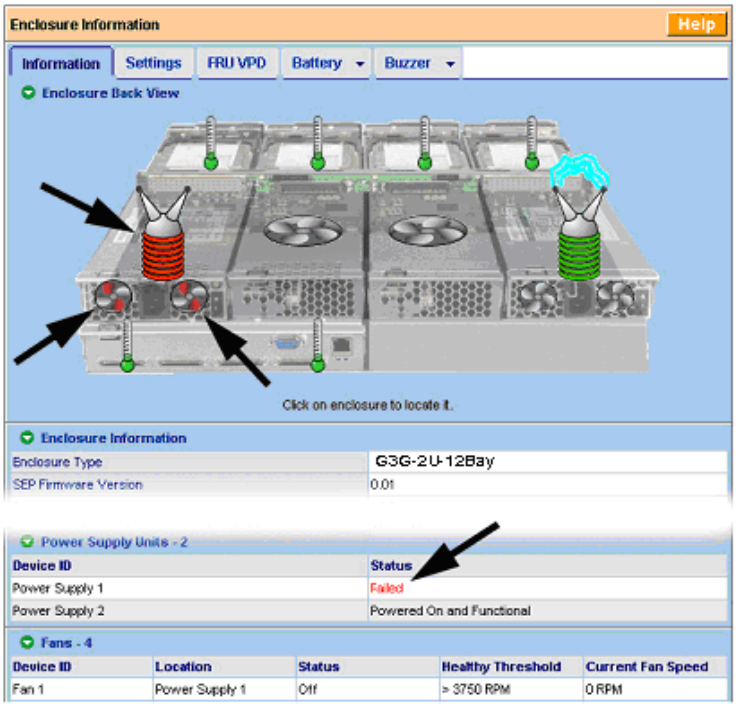
If a physical drive fails during a transport, or you do not move all of the physical drives to their new locations, the Galaxy Array Manager will display an incomplete array.

8.9 Enclosure Problems

GAM displays yellow exclamation points ! and red Xs ✕ in the Tree View to identify components that need attention.

When a yellow ! appears over a Subsystem in Tree View, click on the Enclosure icon. The Enclosure screen will display (below).

Fig 8.9a Galaxy 3G GAM shows Enclosure information



In this example, a power supply has failed. The Enclosure Diagram displays color and motion changes to identify the failed power supply. In this case, you must replace the power supply.

Note that the image above was shortened to fit on the page.

Overheating

Overheating is a potentially serious condition because the excessively high temperatures can lead to disk drive failure and controller malfunction.

Overheating usually results from:

- Fan failure
- Poor air circulation around the enclosure

GAM reports failed fans along with elevated temperature. On Galaxy3G, there are two kinds of fans:

- Power supply, 2 fans each
- Cooling units, 1 fan each

If a power supply fan fails, you must replace the power supply. If a cooling unit fan fails, you can remove the cooling unit and replace only the fan itself.

No tools are required for either procedure. See the Maintenance chapter for instructions on replacing the fans.

Air circulation around the Galaxy3G enclosure may be a more complex problem. Use the thermometer icons to help you locate the specific hot spot. Check for these conditions:

- Accumulated dust or objects blocking the fans
- Less than a minimum of 5 inches (13 cm) space between the back of the Galaxy3G and the wall or other object
- Ambient temperature above 95°F (35°C) where the Galaxy3G is operating

To cool down a Galaxy3G:

- Correct any problems identified above
- Power it down and let it sit for an hour or longer

Power Supplies

OK

Replace Soon

Replace Now

Galaxy3Gs are equipped with redundant power supplies. The advantage of dual power supplies is that, should one fail, the other will continue powering the subsystem until the faulty one can be replaced. Galaxy3G is capable of operating on a single power supply. As a result, if one power supply fails you must watch the front panel LEDs or the Galaxy Array Manager in order to become aware of the condition.

The power supplies are hot-swappable, meaning you can leave the Galaxy3G running when you replace the bad one. Be careful, however, to remove the faulty power supply and not the good one, or Galaxy3G will come to an immediate stop and your data will be unavailable until the system is powered and booted again.

As noted above, if a power supply fan fails, you must replace the power supply. Without the fan to cool it, the power supply will overheat and eventually fail anyway.

No tools are required for the procedure. See the maintenance chapter for instructions on replacing a power supply.

Battery

Galaxy3G uses a battery as backup power for the cache. Should a power failure occur, the battery enables the cache to hold data up to 72 hours. The battery recharges during normal Galaxy3G operation.

In most cases, installing a replacement battery will correct a marginal or failed condition. The battery is located in the cooling unit above the controller. Remove the cooling unit for access. The battery is hot-swappable.

No tools are required for the procedure. See the Maintenance chapter for instructions on replacing the battery.

Also see “Reconditioning a Battery” .

8.10 Controller Enters Maintenance Mode

When a RAID controller encounters and internal problem, it can enter `maintenance mode`. Maintenance mode is only for remedial action in the event of a problem with the controller.

When a controller enters maintenance mode, it goes offline and it will display `Missing` under Readiness Status.

Note that Galaxy3G subsystems with only one controller will always show that the second controller is "Missing." For Galaxy3Gs with two controllers, one of the controllers will display "Missing" if the controller is improperly connected or removed from the subsystem.

Be sure that both controllers:

- Have the same Firmware version
- Have the same amount of SDRAM
- Are properly installed and connected

To obtain this information for a controller, click on the Controller icon, Information tab, and look for Firmware Version and Memory Size.

To access the controller, use a serial connection. If you know the controller's IP address, you can access the controller using a Telnet connection.

To log into the Galaxy3G CLI:

1. Change your terminal emulation program settings to match the following specifications:
   - Bits per second: 115200
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: none
2. Start your PC's terminal VT100 or ANSI emulation program.
3. Press Enter once to launch the CLI.
4. At the Login prompt, type **`administrator`** and press Enter.
5. At the Password prompt, type **`password`** and press Enter.
6. At the administrator@cli> prompt, type **`ctrl`** and press Enter.

   The controller status will display. The controller whose Readiness Status is `Missing` is in maintenance mode.

8.11 Connection Problems

When you install your Galaxy3G product following the instructions in the Quick Start Guide and this Product Manual, you should have little trouble getting your equipment to work the first time. But connection problems can arise that are not the User's or Installer's fault. Every conceivable problem cannot be covered in the documentation but some guidelines could be helpful.

Connection problems cause a majority of failures in almost any electrical system. While the installation of the cables and components was correct, they don't function properly, or at all, because:

- A connector is dirty or corroded
- A connector is loose or damaged
- A cable looks OK outside but has an open circuit inside
- The wrong cable was used

Galaxy3Gs ship with a full set of new cables, as required for each specific model. Be sure to use these components because: 1.) They are the proper ones for your RAID subsystem, 2.) They are in brand-new condition, and 3.) You paid for them with the purchase of your Galaxy3G.

Serial Connections

Galaxy3G uses a serial connection for the command line interface (CLI) and the command line utility (CLU). After you set the IP address, you can access the CLI and CLU through a network connection, also. Normally, users prefer the Galaxy Array Manager because of its graphic user interface. But the CLI and CLU can do the same jobs. And they will work when your network connection is down.

For Galaxy3G, you must use the CLI or CLU to set the Management Port IP address in order for Galaxy Array Manager to connect with it. See “Setting up the Serial Connection” in chapter 2. This issue is discussed further under Network Connections (below). See the “Making Serial Cable Connections” in chapter 2 for more information on making the connection.

The CLI and CLU control and manage but they do not move data. They communicate through a null-modem cable, supplied with the Galaxy3G. A straight-through serial cable will not work for this purpose. You may choose not use the CLI or CLU often and want to disconnect and store the cable. Consider leaving it connected, to be sure it will be there when you need it.

Network Connections

Each controller has an Ethernet RJ45 Management Port connector on the back of the enclosure. This is a Gigabit Ethernet connector designed to connect to your network. The Galaxy3G becomes a node on your network like any other PC, server or other component with an IP address.

Galaxy3G ships from the factory an IP address of 192.168.1.129. You must change this address to one that will work with your network. You make the initial IP address setting using the CLI or CLU. See “Setting up the Serial Connection”.

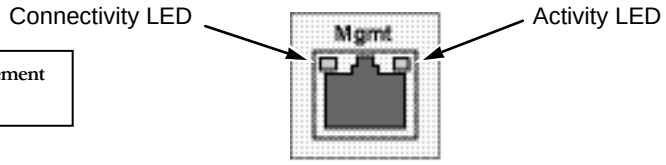


Fig 8.11a Galaxy 3G RJ45 ethernet Management port

LEDs	State			
	Dark	Amber	Green	Flashing Green
Connectivity	10BaseT	1000BaseT	100BaseT	
Activity	No activity			Activity

Note that Galaxy3G Management Port can accept IP address assignments from a DHCP server. Use Galaxy3G's Command Line Utility (CLU) to enable this feature. If you have not activated DHCP support but there is a DHCP server on your network, there is a chance that it will inadvertently assign the Galaxy3G's Management Port IP address to another node. You might see a warning to this effect on your PC's monitor. If this happens, the Galaxy Array Manager may not be able to connect. See your network administrator to work out a suitable arrangement.

Fibre Channel Connections

When there is a connection failure, use Galaxy Array Manager to verify that Galaxy3G sees the initiator(s). See "Viewing Fibre Channel Initiators" .

If Galaxy3G sees some initiators but not the one you want, the problem is most likely elsewhere in the loop or fabric. If Galaxy3G does not see any initiators:

- Check all of the Fibre Channel connections
- Verify that all nodes are properly connected and powered
- Verify that the fabric router or switch is properly connected powered

The Fibre Channel ports, transceivers, and controller on Galaxy3G function the same as comparable components on other nodes.

For more information, see "Managing Fibre Channel Connections" ..

8.12 Browser Does Not Connect to Galaxy Array Manager

If you successfully have setup and connected to Galaxy Array Manager, then suddenly you can no longer connect, it might be the result of the following three conditions:

- DHCP is enabled on your Galaxy3G's virtual management port
- The DHCP server does not have a dedicated IP address for the Galaxy3G
- The Galaxy3G restarted and your DHCP server assigned a new IP address

You must obtain the new IP Address for the virtual management port in order to direct your browser to the Galaxy3G and start Galaxy Array Manager.

To access the new IP address:

1. Start your PC's terminal VT100 or ANSI emulation program.
2. Press Enter once to launch the CLI.
3. At the Login prompt, type **`administrator`** and press Enter.
4. At the Password prompt, type **`password`** and press Enter.
5. Type **`net`** and press Enter.

   ```
   administrator@cli> net

   ==========================================
   CId   Port  Type  IP            Mask          Gateway       Link
   ==========================================
   Virtual           Mgmt          192.168.10.85 255.255.255.0 192.168.10.1      Up
   ```

   The new virtual management port IP address and other network settings display.

6. Enter the new IP address into your browser to log into Galaxy Array Manager.

For more information, see "Setting up the Serial Connection" and "Logging into Galaxy Array Manager"

8.13 Unsaved Data in the Controller Cache

An LED (marked with the L icon) is provided to inform you that there is data in the cache that has not been saved to non-volatile memory. Such data is sometimes called “dirty,” not to suggest it is corrupted in some way but because it has not been saved to a disk drive.

Fig 8.13a Galaxy 3G FC4 dirty cache LED

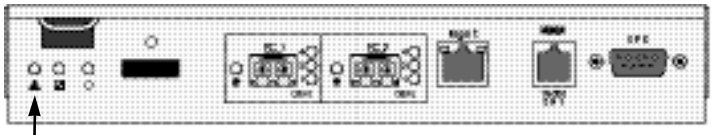
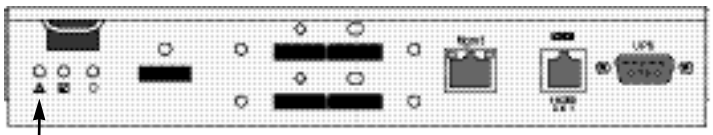


Fig 8.13b Galaxy 3G S3 dirty cache LED



If there is unsaved data in the controller’s cache, the Dirty Cache LED shines amber. During this time, do NOT power down the Galaxy3G. Wait until the LED will goes dark.

Section 9
Support

9.0 Support

This chapter covers the following topics:

- Frequently Asked Questions (below)
- Contacting Technical Support
- Limited Warranty
- Returning Product For Repair

9.1 Frequently Asked Questions

What kind of disk drives can I use with Galaxy3G?

Galaxy3G supports 1.5 and 3.0 GB/s Serial ATA disk drives and 3.0 Gb/s SAS drives.

Can I take the disk drives from my Galaxy HDX, put them into the Galaxy3G and keep my disk array or logical drive intact?

No, the Galaxy HDX and HDX2 subsystems used a proprietary method of disk metadata, stored in the reserve sector of each physical drive that are not compatible with the Galaxy3G.

The drives can be used by initializing them and building a new RAID on the Galaxy3G but all of the Galaxy HDX data will be lost.

Galaxy3G does not support Parallel ATA (PATA) disk drives.

Note that if you move the disk drives from the Galaxy3G to the HDX subsystems, they will not recognize your disk array or logical drive.

How can I tell when the Galaxy3G has fully booted?

When the Galaxy3G is fully booted up, the Power and FRU LEDs will light up green. If a disk array is present, the Logical Drive LED will light up green also. The Controller heartbeat LED blinks once every two seconds.

Why does Galaxy3G come with a Command Line Utility?

First, it is used to assign your Galaxy3G an IP address in order for the GAM management software to connect to it. Second, in the event of a network failure, you can still access the Galaxy3G. Third, some users prefer the Command Line Utility.

GAM connection was working OK. But later on, it timed out. What do I do now?

The network conditions can time-out for several reasons. When an open connection has no action for a specific amount of time (the Administrator can change it), the connection times-out automatically for security reasons. When you attempt to use GAM, it returns to the login screen. Enter your user name and password and click Login, and GAM will establish a new connection. See “Making Web Server Settings”.

I can access the Galaxy3G over my company’s intranet. But I can’t access it from an outside Internet connection. How do I make the Internet connection work?

This condition is not related to Galaxy3G, but is due to your firewall and network connection protocol. Contact your MIS Administrator.

Why can a RAID 1 logical drive on Galaxy3G consist of only two disk drives?

On the Galaxy3G, RAID 1 logical drives work in mirrored physical drive pairs. You could create up to six RAID 1 logical drives. Or you can create a single RAID 10 logical drive with data mirroring and up to 12 physical drives. If you have an odd number of drives but still want data mirroring, use RAID 1E.

See “Installing Disk Drives” and “Introduction to RAID” for more information on the number of physical drives you can use for each RAID level.

Are logical drives on Galaxy3G limited to 2 TB?

No. But verify that your operating system and HBA supports logical drives over 2 TB. Also, for the operating system to recognize the full capacity of logical drives over 2 TB, you must specify a sector size of 1 KB or larger when you create the logical drive. See “Choosing Sector Size” for more information.

I have two Galaxy HDX and use RAID Watch to monitor them. Can I use my existing RAID Watch setup to monitor the Galaxy3Gs also?

No. Use the GAM embedded with the Galaxy3G

How can I be sure everything is working OK on the Galaxy3G?

Locally: The Galaxy3G enclosure has LEDs on the front to monitor the status of power, field replaceable units (FRUs) and logical drives. When these are green, Galaxy3G is functioning normally.

Remotely: Check the Tree Icons in GAM. If there are no yellow or red warning icons displayed, Galaxy3G is functioning normally.

What happens if a logical drive goes critical?

On the front of Galaxy3G, the logical drive LED turns amber and an audible alarm sounds. See “Critical & Offline Disk Arrays”.

Can Galaxy3G run using just one power supply?

Yes, it is possible to run Galaxy3G on a single power supply. There are two power supplies so that Galaxy3G will continue running if one of the power supplies fails. But deliberately leaving one power supply off negates this advantage.

In addition, leaving one power supply off reduces air flow through the Galaxy3G enclosure and can contribute to overheating. Always switch on both power supplies.

9.2 Contacting Technical Support

Rorke Technical Support provides several support options for Rorke users to access information and updates. We encourage you to use one of our electronic services, which provide product information updates for the most efficient service and support.

If you decide to contact us, please have the following information available:

- Product model and serial number
- Version of OS, HBA, and driver version numbers
- System configuration information, including: application software
- A description of the problem / situation

United States

E-mail Support	techsupport@rorke.com
Phone Support	800 328 8147
Fax Support	952 829 0988 Attn: Technical Support
If you wish to write us for support:	Rorke Data Inc 7626 Golden Triangle Drive Eden Prairie, MN 55344 Attn Technical Support

9.3 Limited Warranty

Rorke Data, Inc. (“Rorke”) warrants the Galaxy3G for three (3) years from the time of the delivery of the product to the original destination and :

a) will conform to the Galaxy3G specifications;

b) will be free from defects in material and workmanship under normal use and service.

This warranty:

a) replaces any defective component within the first 30 days after delivery

b) repairs any defective components [usually taking 4 weeks} within the warranty period.

c) is assigned to the original owner and is not transferable

d) is valid only within the 3 years from date of delivery

e) is not valid on spare parts, fans, and power supplies

This warranty does not:

a) replace or swap defective components. See Proservice programs

b) provide on site support or after hours support. See Proservice programs

This warranty shall not apply to defects resulting from:

a) improper or inadequate maintenance, or unauthorized modification(s), performed by the end user;

b) operation outside the environmental specifications for the product;

c) accident, misuse, negligence, misapplication, abuse, natural or personal disaster, or maintenance by an unauthorized service center.

Proservice Programs

Rorke provides a complete set Proservice Programs, technical and logistical programs, for most of it product lines. Some of these programs include:

- On-Site Maintenance Contracts
- Enhanced Warranties
- Installation Services
- Depot Repair
- 24 x 7 On-Site Maintenance
- 9 x 5 On-Site Maintenance
- Advanced Part Exchange Maintenance
- Software Support Contracts

Check the website http://www.rorke.com/pro_service.cfm and contact Rorke’s Proservice Sales representative for the technical and logistical options you want to utilize.

Disclaimer of other warranties

This warranty covers only parts and labor, and excludes coverage on software items as expressly set above.

Except as expressly set forth above, Rorke DISCLAIMS any warranties, expressed or implied, by statute or otherwise, regarding the product, including, without limitation, any warranties for fitness for any purpose, quality, merchantability, non-infringement, or otherwise. Rorke makes no warranty or representation concerning the suitability of any product for use with any other item. You assume full responsibility for selecting products and for ensuring that the products selected are compatible and appropriate for use with other goods with which they will be used.

Rorke DOES NOT WARRANT that any product is free from errors or that it will interface without problems with your computer system. It is your responsibility to back up or otherwise save important data before installing any product and continue to back up your important data regularly.

No other document, statement or representation may be relied on to vary the terms of this limited warranty.

Rorke shall not be liable for the cost of procuring substitute goods, services, lost profits, unrealized savings, equipment damage, costs of recovering, reprogramming, or reproducing of programs or data stored in or used with the products, or for any other general, special, consequential, indirect, incidental, or punitive damages, whether in contract, tort, or otherwise, notwithstanding the failure of the essential purpose of the foregoing remedy and regardless of whether Rorke has been advised of the possibility of such damages. Rorke is not an insurer. If you desire insurance against such damage, you must obtain insurance from another party.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, so the above limitation may not apply to you.

This warranty gives specific legal rights, and you may also have other rights that vary from state to state.

Your Responsibilities

You are responsible for determining whether the product is appropriate for your use and will interface with your equipment without malfunction or damage. We strongly suggest consulting with our sales and technical staff for the purpose of the Galaxy3G's compliance to your usage and expectations of the product. You are also responsible for backing up your data before installing any product and for regularly backing up your data after installing the product. Rorke is not liable for any damage to equipment or data loss resulting from the use of any product.

9.4 Returning Product For Repair

If you suspect a product is not working properly, or if you have any questions about your product, contact our Technical Support Staff through one of our Technical Services, making sure to provide the following information:

- Product model and serial number (required)
- Return shipping address and email address
- Daytime phone number
- Description of the problem

The technician will assist you in determining whether the product requires repair. If the product needs repair, the Technical Support Department will issue an RMA (Return Merchandise Authorization) number.

Important

Obtain an RMA number from Technical Support before you return the product and write the RMA number on the label. The RMA number is essential for tracking your product and providing the proper service.

Return ONLY the specific product covered by the warranty (do not ship cables, manuals, diskettes, etc.):

USA and Canada:	Rorke Data Inc 7626 Golden Triangle Drive Eden Prairie, MN 55344 800 328 8147
Other Countries:	Return the product to your dealer or reseller. Contact them for instructions before shipping the product.

You must follow the packaging guidelines for returning products:

- Use the original shipping carton and packaging
- Include a summary of the product's problem(s)
- Write an attention line on the box with the RMA number
- Include a copy of proof of purchase

You are responsible for the cost of insurance and shipment of the product to Rorke. Note that damage incurred due to improper transport or packaging is not covered under the Limited Warranty.

When repairing returned product(s), Rorke may replace defective parts with new or reconditioned parts, or replace the entire unit with a new or reconditioned unit. In the event of a replacement, the replacement unit will be under warranty for the remainder of the original warranty term from purchase date, or 30 days, whichever is longer.

Rorke will pay for standard ground based return shipping charges only. You will be required to pay for any additional shipping options (such as express shipping).